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The AUTOMOBILE

Wind Resistance—The Purloiner of Power The White Plague of Speed

Road Tests Demonstrate Conclusively That Surface Contour of Car Has Important Bearing on Fuel Consumption and Speed—Influence of Streamline Types

By Robert W. A. Brewer

THE development of the modern racing car in Europe is a concrete example of the manner in which high speeds can be obtained by the elimination of extraneous resistances, as distinct from the earlier practice of providing engines of ultra-large size to propel a chassis along the road, no special care being taken to eliminate the opposing resistances to the forward motion.

Aviation in its progress has taught us that careful design results in the elimination of head resistance, by the suitable formation of any body which might offer resistance to the wind, including the housing of such essential details as the engine and the aviator.

Having had occasion to make considerable use of the track and of the road for the purpose of testing during the last few years, it has occurred to me that the ordinary user of a car, and very often the designer, is not fully cognizant of the enormous variations which occur in road resistance as well as in wind resistance.

It is futile to rely upon data obtained by *various* experimenters under *various* conditions of working, as these conditions are liable to differ very greatly from place to place and from time to time.

The performance of a certain engine when fitted to a car in regard to the speed and fuel consumption, carries no conviction unless the work it performs is taken into consideration, being computed by exact measurement of the resistance overcome.

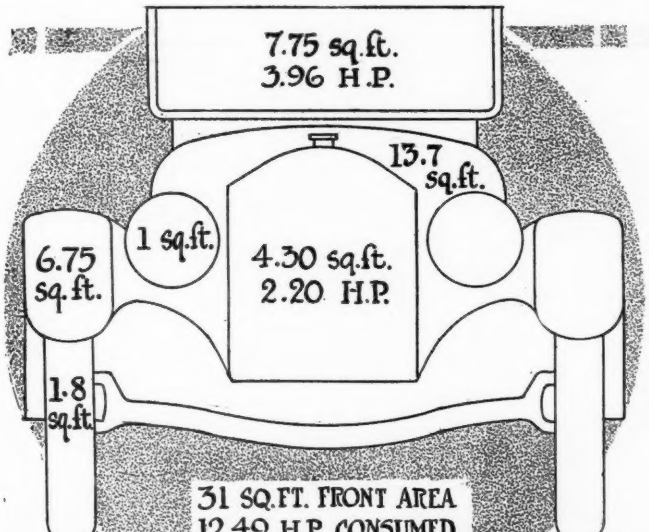


Diagram showing the areas presenting resistance to the wind with the equivalent horsepower consumptions at 40 miles an hour

As a result of my investigations, I have endeavored to give greater prominence and exactness to the question of resistance, so that in making comparisons of one carbureter, for example, or one fuel, for example, with another fuel or carbureter, too much reliability cannot be placed upon the figures of the performance, without taking into consideration various other matters which greatly affect the whole result.

The automobilist, on the other hand, is sometimes led to believe that his engine is not performing so well one day as another, being guided solely by the resulting speed of the car, and he may look for trouble in an entirely wrong direction. For this reason a careful study of the following tests will often assist him to elucidate what might otherwise be an abstruse phenomenon.

We will first investigate the subject of wind resistance as impressed upon the automobile as a whole. The projected area of a body under such circumstances is some indication as to the resistance afforded at any particular speed, but it is very difficult to decide the necessary factors for various forms of entry other than normal surfaces. For this reason resistance tests are preferably made by exact methods by use of the accelerometer.

The Wimperis accelerometer has already been described in the pages of THE AUTOMOBILE, and its application to the determination of horsepower explained. The accelerometer,

however, is very useful for other purposes than a simple measurement, as its sphere of usefulness is very wide and enables the experimenter to obtain most important data which should have the careful consideration of any modern or progressive designer. The streamline formation of body is a somewhat difficult one upon which to base calculations, and its resistance factor to wind can be variously estimated somewhere about half that for normal surfaces. In addition, account must be taken of the effect of one surface which comes immediately behind another or at some distance, as an example, the fenders and wheels. In calculating, the area of all the four fenders should be taken into consideration by reason of their distance apart, but in some forms of design there is no doubt that the resistance of the wind can be kept below the value thus arrived at.

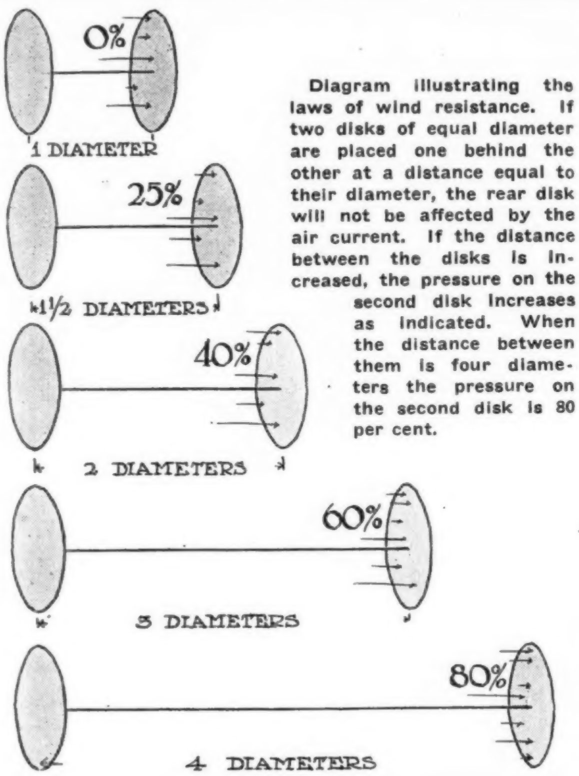


Diagram illustrating the laws of wind resistance. If two disks of equal diameter are placed one behind the other at a distance equal to their diameter, the rear disk will not be affected by the air current. If the distance between the disks is increased, the pressure on the second disk increases as indicated. When the distance between them is four diameters the pressure on the second disk is 80 per cent.

Air Pressure on a Disk

If a flat disk be placed in an air current with a second disk of similar shape behind the first one, at a distance equal to its diameter, the rear disk will not be in any manner affected by the air current.

If the distance between the disks be one and one-half diameters, the pressure on the rear disk will be 25 per cent. of that on the front one; and at two diameters apart the value will be 40 per cent. A further separation of these disks to a distance of three diameters and four diameters will increase the pressure on the rear disk to 60 and to 80 per cent., respectively, of that on the front disk. It will, therefore, be seen that the presence of eddies must be taken into account in calculating the wind resistance of irregular bodies such as a motor car.

Resistances set up by other surfaces than normal plane ones are, for a sphere about one-third of that of a plate of the same diameter; and a cylinder which presents its convex surface to the air flow experiences one-half the pressure that would be exerted upon a plate of the same projected area.

Effect of Streamline Formation

The object of a streamline formation being to transpose normal pressure into skin friction, it is as well to bear in mind that the latter is only of about one two-hundredths of the value of the former. We may take it that the well-known formulæ apply, relating the pressure in pounds to the projected area in square feet and the velocity of the body in miles per hour, the formula reading:

$$P = 0.003\ A\ V^2.$$

Where the pressure is in pounds the area in square feet and the velocity in miles per hour, and that the pressure varying as the square of the velocity the power absorbed varies with the cube of the speed. See Table I, page 584.

With the perfection of the modern accelerometer it has been possible to obtain accurate results, and in order to carry out my investigations, I made observations at various points on the circuit of Brooklands track on several days. Note was taken how the resistance varied from day to day according to the direction of the wind. Further observations were made with a different brand of lubricating oil and again with the top half of the windshield removed, so that the calculations could be based upon the resistance of a normal surface and the deductions made therefrom as to the resistance of the remainder of the body of the automobile.

The car in question had a projected area made up as follows:

7.75 sq. ft. of normal area in the wind screen.
13.7 sq. ft. of projected area in the body, of which 4.3 sq. ft. represented the normal area of the radiator.
6.75 sq. ft. projected area of fenders, which were domed.
1.8 sq. ft. projected area of the lower halves of the four wheels.
1.0 sq. ft. Lamps.

Total 31.0 sq. ft.

In the above calculation, the projected area of all four fenders and half of all four wheels, is taken into account, and in considering the body, although this was 56 inches wide, the hood was tapered and ran out by an easy curve into the scuttle, the rear end of the car being formed by an easy sweep.

Top a Big Factor

Considerable resistance, however, was due to the presence of the top, which would undoubtedly be subjected to eddy currents caused by the lower half of the wind screen when the latter only was in use, and this was exactly measured.

The top was folded back and not incased, being of heavy leather, the design of the body being a single three-seated cabriolet.

For the purpose of calculating the various portions of the measured resistance, a figure was taken which fairly represented the plane normal area, and from the measurements this was arrived at as follows:

The radiator and number plate represent 4.3 square feet of the total area of the body so that the normal area is as follows:

Windshield	7.75 square feet
Radiator	4.30 square feet
Lamps	1.00 square feet
Fenders	6.75 square feet
Total	19.80 normal area

As the total area is 31 square feet there is a balance of 11.2 square feet of curved entrant surfaces, and a factor of 0.5 for these makes the equivalent normal surface 5.6 square feet or a total of 25.4 square feet of normal area—say 25.5 square feet.

Of this, the removable top part of the windshield is 3.5 square feet in area, and its center of pressure is 63 inches from the ground level.

Table II, page 584, gives the theoretical pressure due to wind resistance *alone* upon this area of 25.5 square feet.

Speeding Is Expensive

We may take it for a fact that on a journey where an average speed of 25 miles per hour is maintained, a great part of the traveling is done in spurts at 40 miles per hour. This is where the expenditure of money occurs, for not only do the tires suffer thereby, but the fuel costs mounts.

In view of the fact that the observed resistance for the windshield agrees with the theoretical deductions when taking the car speed as the relative speed of the car through the air (on

a still day), it is of interest to see how the various parts of the car contribute towards the total requirements from the engine. Table III gives a good indication of this, taking into account the wind only.

The actual rolling resistance was measured and amounted to approximately 50 pounds per ton, and as the car in question weighed 1.5 tons this was equivalent to a force equal to the weight of 75 pounds necessary to move the car along. This rolling resistance did not vary appreciably with the speed and theoretically it should not do so except in so far as power is absorbed by the tires at very high speeds. The power absorbed is therefore the resistance multiplied by the speed of the car in ordinary units.

Wind Pressure Influences Economy

We see from Table IV. that any comparison of fuel consumption is of no value whatsoever, unless a measure of the resistance is given at the same time.

Even the speed of the car is not of sufficient indication, as the horsepower output at that speed is subject to great variation, except perhaps in automobiles whose wind resistance is extremely small.

Tests at Low Car Speeds Misleading

Further, fuel consumption tests at low car speeds are very misleading, as the power output of the engine is very low, and engine friction and losses may easily outweigh any difference in either the fuel or the carbureter.

Let us go a step further and notice how, even at the same speed, the power may vary still further. We will take a few examples, as in Table V. on page 584.

In order to obtain an experimental value for the direct resistance caused by a normal surface, a run at 40 miles per hour was made, first with the car under ordinary conditions and secondly with the top half of the screen removed.

The reduction in area due to this removal was 3.5 square feet, and the resistance readings with the screen removed compare as follows:

	MEAN RESISTANCE —POUNDS PER TON STRAIGHT	BANK	FORK
With windshield—top half	107	125	140
Without windshield—top half	97	115	110
Difference	10	10	30

Assuming that the average difference in pressure is about 17 pounds per ton, this is equivalent to a total pressure on the top half of the windshield of 25 pounds or 3 horsepower maximum and 1.6 horsepower minimum, which agrees very well with the theoretical values which are set forth in Table III which appears on page 584.

Turning now to calculate power absorbed by the total screen of 7.75 square feet area, this is 3.96 horsepower at the same speed, that is, 40 miles per hour as indicated by the figures in Table III.

It will thus be seen that a mean experimental value of 2.3 horsepower on 3.5 square feet is slightly in excess of the theoretical value of 3.96 horsepower on 7.75 square feet, which is 1.8 horsepower. This in all probability is due to the eddy currents which the screen produces, striking down into the folded top. The eddy current effect in the top is therefore $2.3 - 1.8 = 0.5$ horsepower.

Power Varies with Resistance

Naturally great care must be taken in making speed observations, particularly at high speed, as the horsepower output varies with the resistance, therefore as the cube of the speed, being V^2 variation for wind, multiplied by V the linear velocity of the car. This variation of resistance is in many cases accountable to conditions of the wind as we have only been considering car speeds and not the algebraic sum of car and wind speed.

In making use of a complete car for carrying out fuel consumption observations, only a slight indication can be obtained of the real value of any particular fuel or apparatus, unless a complete set of observations are made, and these observations should certainly include resistance measurements.

Rolling Resistance Practically Constant

The rolling resistance of a car of this type is practically constant, and the increase in power output demanded from the engine is chiefly caused by the wind pressure and eddy currents under ordinary working speeds. Further, at low speeds, such as 20 miles per hour, the necessary power required to propel a car is comparatively small on a smooth, level road. Thus any consumption tests made at such speeds as these are very liable to error, first by reason of the low load factor of the engine, and second on account of the comparatively great variations which occur in the resistances when considered in conjunction with the power output of the motor.

Excrescences Increase Running Cost

The more extraneous matter on a motor car body, the higher will be the working cost, for not only does the cost of fuel mount up, but the driving pressure through the tires, and consequently their wear and cost. Every square foot costs money, but in many cases comfort in riding can only be obtained as a result of a considerable area to divert the effect of the wind. Many of the modern sporting bodies, though offering small wind resistance, are extremely uncomfortable, but much can be done by scientific arrangement to improve their comfort and keep their operating costs low.

Continuing the question of costs, let us see approximately what the fuel cost alone amounts to in connection with the use of a flat windshield such as is fitted to the car under consideration.

Suppose the car is traveling at 20 miles per hour and the brake horsepower averages, say, 6.5 on the level, and at that speed the rate of fuel consumption is 25 miles per gallon. At 40 miles per hour the power demanded from the engine is approximately three times that amount, say 19.5 horsepower, and of this the windshield requires approximately 4 brake horsepower, or, say 60 per cent. of the power required to drive the complete car at 20 miles per hour. Taking gasoline at 40 cents per gallon, the fuel cost per mile is 1.6 cents per mile and 60 per cent. of this is 0.96, that is, it costs nearly 1 cent a mile for fuel for the windshield when traveling at a speed of 40 miles per hour.

This figure is not strictly true as, although the motor develops three times the power at 40 miles per hour as it does at 20 miles per hour, yet the fuel consumed per mile is not three times as great.

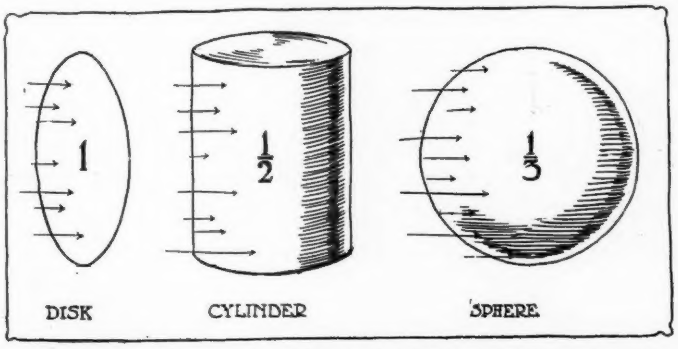


Chart illustrating the importance of surface contour in air currents. A flat surface such as a disk presents the maximum resistance. A cylinder offers but one-half that of a disk, while a sphere reduces the resistance to one-third

Efficiency of Motor a Factor

The fuel consumption per *hour* is *nearly* three times as great, *nearly*, because the mechanical efficiency of the motor is greater at 40 miles per hour than it is at 20, so with, say, three times the amount of fuel at the higher speed per hour, the car should go twice as far as at the lower speed. The wind resistance even at the higher

Table I—Table of Wind Pressure on Normal Surfaces

Speed in Miles per Hour	Pressure in Pounds per Square Foot
20	1.20
25	1.875
30	2.700
35	3.675
40	4.800
45	6.075
50	7.500

Table II—Table of Wind Pressure on Test Car, and Horsepower Absorbed by Wind Alone

Speed Miles per Hour	Pressure on Car, in Pounds	Equivalent Horsepower	Pressure on Top Half of Screen in Pounds	Equivalent Horsepower
10	7.6	0.2	1.05	....
20	31.0	1.65	4.20	....
30	69.0	5.53	9.45	0.75
40	122.0	13.0	16.8	1.78

speed due to the windshield is in the ratio of 4 to 19.5, that is, about 20 per cent. of the whole, so reckoning in this manner, if it costs 1.6 cents per mile at 20 miles per hour, and it takes 3 times as much fuel to go twice the distance in an hour at 40 miles per hour—we have $\frac{1.6 \times 3}{2} = 2.4$ cents per mile for fuel at 40 miles per hour, and 20 per cent. of this for the screen is roughly 0.5 cent.

In passing it may be noted that the engine was never developing its full power under these tests as, in making flying laps, the brake horsepower was about 35, but experimental difficulties occurred in making observations at above 40 miles per hour.

Conclusions from Tests

In conclusion, the differences in resistance which are brought out by this series of observations conclusively prove the importance of studying the contour and general form of a motor car body, and of bearing these features in mind when comparing speed or fuel consumption performances. The elimination of flat surfaces and correct formation of the rear parts of any objects offering wind resistance becomes most important, particularly at high speeds. Apart from high car speeds it must be remembered that the wind blows on many occasions in frequent and powerful gusts, and though the latter are sometimes imperceptible to the occupants of a car, yet the engine has sensible indications of the demands made upon it by the added resistance due to this wind pressure.

Accessories Interfere with Stream Lines of Car

AS the speed of the car increases above 25 miles per hour, the curve of wind resistance begins to take a sharp upward turn and increases at more than the square of the speed. At 40 miles an hour the resistance becomes so marked that it forms an appreciable part of the power consumed in doing useless work. For this reason it is essential if a car is to be designed for the greatest possible economy, to remove from the contour of the body lines such disturbing elements as oppose an unwarranted amount of surface to the wind.

Windshields Oppose Resistance

The older makes of cars had a windshield surface which rose in a perpendicular plane above the rear end of the engine bonnet. This has now been modified so that now the windshield base at least is moulded into the bonnet curve, thereby furnishing a surface which opposes a minimum amount of flat area to the wind. Above the windshield base, however, the windshield continues to rise and oppose as flat a surface as ever except in the few examples where a sloping shield has been adopted. This is one of the points where a greater amount of surface-moulding would be well repaid at car speeds which range around 30 miles an hour and above.

The fenders and mud guards oppose also a considerable amount of space which materially increases the wind resisting surface. Of late years the curved fender, which is crowned so as not only to cover the wheel to a greater extent but also to conform with the streamline form of the remainder of the car, has come into favor. The resistance of this type of fender is materially less than that of the old flat type found on cars of a decade ago. This is another point, however, that could be improved by giving the streamline effect which is so necessary in reducing to a minimum the detrimental wind resistance. An example where this has been done and where the ornamentation of the car has been materially increased at the same time is in the foreign Bugatti which is a small vehicle especially built for speedy work.

Remove Projecting Accessories

The average car user who runs at speeds above 30 miles an hour is little aware of the gain in mileage per gallon that he could make if he were careful to remove the projecting surfaces which break up the streamline effect. The old fashioned oil lamps hanging from the sides, the tires carried on the running boards and many other semingly small, but, in the aggregate, large, areas can be removed from the car to good effect. It is really the accessories of the car that do most towards breaking up the streamlines as the car designer generally brings out a harmonious whole. Therefore it is true that the larger the number of accessories which are built into the car the less the unnecessary area presented to the opposing wind.

Table III—Power to Drive at 40 Miles per Hour at 4.8 Pounds per Square Foot Pressure

	Area in Sq. Ft.	Pressure in Lbs.	Horsepower Absorbed
Screen	7.75	37.2	3.96
Fenders	6.75	32.4	3.46
Body	5.60	26.9	2.87
Radiator	4.30	20.6	2.20
Total	....	....	12.49

Table IV

Speed M.P.H.	Brake H.P.	
	Max.	Min.
20	6.4	4.0
30	13.2	10.8
40	25.6	20.8

Table V

Speed M.P.H.	Brake H.P. at Marked Spots			
20	6.9	6.8	6.0	5.0
30	15.1	14.2	12.0	10.2
40	23.2	....	18.4	....

Note.—The above readings were taken under the same conditions of car and upon different days, thus showing why it is that a car may appear to run better one day than another.

Small Motors Have High Efficiency

British Designers Claim Remarkable Results from Motors Developing Full Horsepower at More Than 3,000 R. P. M.

By D. McCall White

WE have been producing in Great Britain high speed engines for the last 4 or 5 years which will run successfully in touring automobiles without any more trouble than the ordinary slow speed engines. In fact, 5 years ago the company I was connected with was in a position to give a 3 years' guarantee with their automobiles, the engines of which ran at a maximum speed of about 2,300 to 2,600 revolutions per minute. Within the last 2 or 3 years we have been producing engines in automobiles which have been producing maximum power at 2,400 revolutions per minute, and these have on the slightest downgrade accelerated to 2,800 revolutions per minute.

Success in Colonies

These particular automobiles have not only been successful in the British Isles, but have been highly satisfactory and successful in our colonies, such as for example, Australia, New Zealand, etc., where the roads are, I think, pretty much on a par with American roads. In fact, I have, just before leaving England, inspected a report from one of my assistants who was out in Australia inspecting and generally looking into the matter, and his report, as well as the agent's report on the behavior of automobiles out there, not only of our own production but those produced by other firms which were also of the high speed class, was entirely satisfactory. Another firm, which whom I have not been connected, have been most successful in the Colonies, not only in competitions such as hill climbing, but in competitions of great hardship over large tracts of land such as you are accustomed to in this country. I am particularly aware of the points in connection with this particular firm, as the engineer is a personal friend of my own.

I am stating these points because, in discussing them with some of your engineers I have found that an erroneous idea seems to exist regarding the durability of the high speed engine, fitted into a moderately light chassis. In the first place, the chassis which these engines are called upon to pull, are not very light chassis, being in most cases just about the same weight as some of your most modern chassis. These chassis are designed to stand up, and they do stand up, not only in Britain but also in the Colonies.

A horsepower represents 33,000 foot pounds of work, whether it be developed in Britain or in America, and if this horsepower can be obtained with a smaller engine, then greater economy will be the result.

Power Attained at Speed

Gasoline may be cheaper here than it is in Britain, but I have yet to see the man who refuses to accept the same result as he previously obtained by paying less money for it. As examples of what has been done, I have designed a four-cylinder engine 2 11-16 inches, which developed 36 brake horsepower at 2,600 revolutions per minute, fitting it to a chassis with a wheelbase of 110 inches, the weight being 1,680 pounds. This automobile was beautiful to handle and it was a marvel to see what it could do on the top gear with a load. It could pull on top gear at 10 miles an hour, on a very good gradient, in practically the same manner as a six-cylinder automobile, this engine being 3 1-4 by 5 inches. The wheelbase of the six was 126 inches and the chassis weight 2,632 pounds, both chassis carrying a load of driver and one passenger, plus the weight of 896 pounds.

As regards speed, the small automobile was only some three or four miles an hour slower than the larger one. Obviously, the small engine was more efficient and developed a much higher mean effective pressure than the larger engine.

Undoubtedly, the most efficient valve mechanism which can be designed is the overhead valve system, because the combustion chamber is more perfect and presents less cooling surface to a given volume of gas than any other arrangement. This arrangement of gear, however, has the inclination to become noisy, as, due to the inertia of the valve gear, which is undoubtedly greater than with any other type and naturally requires correspondingly stronger springs to prevent valve chatter, the rocker pins, etc., soon develop a certain amount of play or wear. If the engine is not of this type, then there is no necessity for overhead valves.

One can get highly satisfactory results from the exhaust valve in the orthodox position, with overhead inlet valve, and as the power of the motor depends largely upon its volumetric efficiency it will be easily appreciated, when I state that about 15 to 25 per cent. more charge can enter the cylinders for a given size of valve, with this arrangement, than with the arrangement as presented by the L-head type of motor.

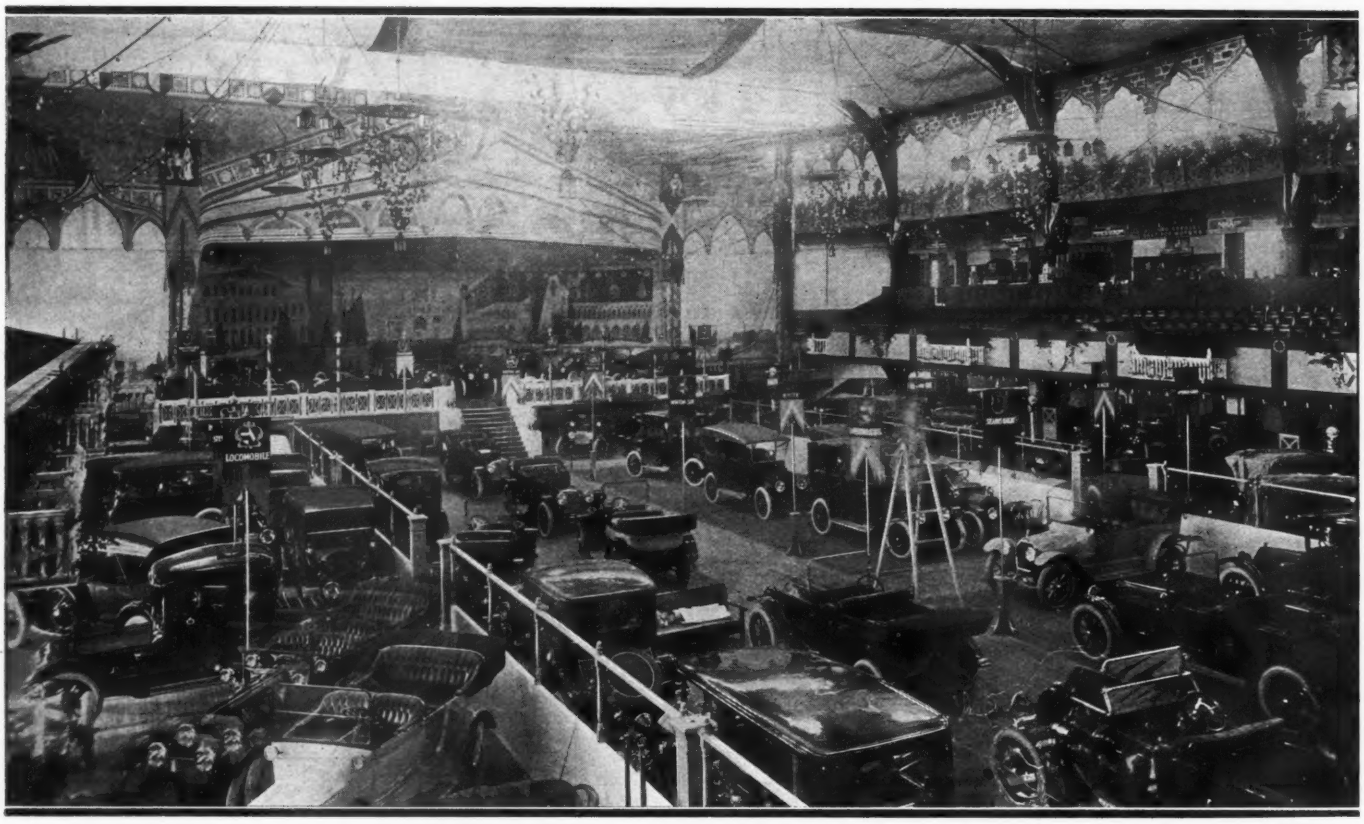
I have been astonished to find how many of your engineers on this side still favor the T-head type. This arrangement of valve gear I have found to be the most inefficient on record. and in order even to get moderate efficiency it is necessary to use a two-spark magneto with two sparking plugs, one on either side of the combustion chamber. I have proved this contention more than once, and it has also been proved for me by the fact that two sparking plugs make very little difference in the L-headed type of motor.

Obtaining Better Efficiency

I know that we have been obtaining more horsepower than many makers on this side are obtaining from their engines, with practically the same number of revolutions per minute, which means that we can use an engine considerably smaller in size to obtain the same results. For ordinary sizes or motors, in racing, it is in my opinion entirely unnecessary to fit multiple valves unless it is desired to try and run the engine somewhere about 5,000 revolutions per minute, or unless the bore of the cylinder was so large and the stroke so long that the sizes of the two ordinary valves would be out of the question.

Regarding the design of valves and valve gear generally, I may say that just lately I have been associated with experiments upon an engine running at 4,000 revolutions per minute and developing power at that speed, the valves of which were side by side in the conventional L-headed cylinder, and the results were certainly astonishing.

I have been using on my own automobile an engine which developed its full power at 3,000 revolutions per minute, the bore being 3.125 inches and the stroke 5.125 inches. The wheelbase of the chassis was about 126 inches and the chassis weight was about 1,900 pounds. This automobile could touch about 70 miles an hour in touring trim, open torpedo body but no wind screen.



Looking west in Grand Hall, at the Boston automobile show, giving an idea of the Venetian scheme of decoration

Boston Opens Record-Breaking Show

Big Dealers' Exhibition Surpasses New York and Chicago in Both Number of Cars and Exhibits

BOSTON, MASS., March 10—Boston's Automobile Dealers' show, the motor mecca of all New England's branch houses, dealers, and sub-dealers, opened Saturday night on its annual week's run in the Mechanics Building, and bids fair to rival in attendance and interest any of the previous eleven shows held in this city.

A Dealers' Show

Boston's show is essentially a dealers' show, all of the car exhibits being by local dealers or branch houses, and from a numerical point of view, although a dealers' show, it surpasses in numbers of exhibits and numbers of cars either the New York or Chicago national shows. There are on exhibit here 288 cars and chassis of gasoline, electric, and steam types, the newly arrived cyclecar being included in this total. Altogether 261 complete cars are shown and twenty-seven chassis are on exhibition.

There are eighty-two exhibits of gasoline cars and cyclecars in addition to which seven makers of electrics and one steam representative have exhibits, giving a grand total of ninety different car concerns. These include all of the leaders in the gasoline line in America and the names of Renault, and Fiat, the former being the only imported cars shown. From an importer's point of view the present show is less attractive than that a year ago when the importers conducted an exhibit of their own in the ball-room of the Copley Plaza hotel.

Features of the Show

Car Exhibitors	90
No. of Cars Shown	261
No. of Chassis	27
Gasoline Car Exhibits	82
Electric Car Exhibits	7
Steam Car Exhibit	1
Decoration Scheme	Venetian

Not an Electric Show

The show is scarcely the equal of either New York or Chicago as an exhibit of electric passenger cars, of which seven are present, namely, Detroit, Ohio, Waverley, R. & L., Buffalo, Century and Bailey.

The cyclecar contingency is well represented with eight concerns, several of which show bodies and chassis incorporating many improvements over the exhibits seen at either New York or Chicago, and which exhibit bears proof of the fact that some of these builders are actually producing cars, and that others have their demonstrators at least in the hands of their dealers. Among the makes represented are Imp, Laconia, Lavigne, Merz, Trumbull, Twombly, Euclid and Economycar. There are the two small cars, namely Saxon and Car-Nation, which occupy a division by

themselves between the cyclecar and the present light automobile.

While an acknowledged leader from a car exhibit point of view, the present show cannot be considered so successful when considered as an exhibit of accessories which is largely due to the fact that the show was not sanctioned by the Motor & Accessory organization, which represents the majority of the accessory manufacturers of the country. This organization made a canvass of its members in the form of a mail vote to find out if they desired to exhibit at local shows, and the result of this vote was approximately fifteen in favor of exhibiting at these shows and 263 opposed. As a result of this vote it was decided not to take exhibit space at the Boston show, and according to the constitution of the accessory association none of its members were permitted to exhibit at the show. Consequently where products made by the manufacturers who are members of the accessory association are shown the exhibits are made by the local dealers, who, in one space, may show a dozen different accessories which occupied separate exhibit spaces at the New York and Chicago shows.

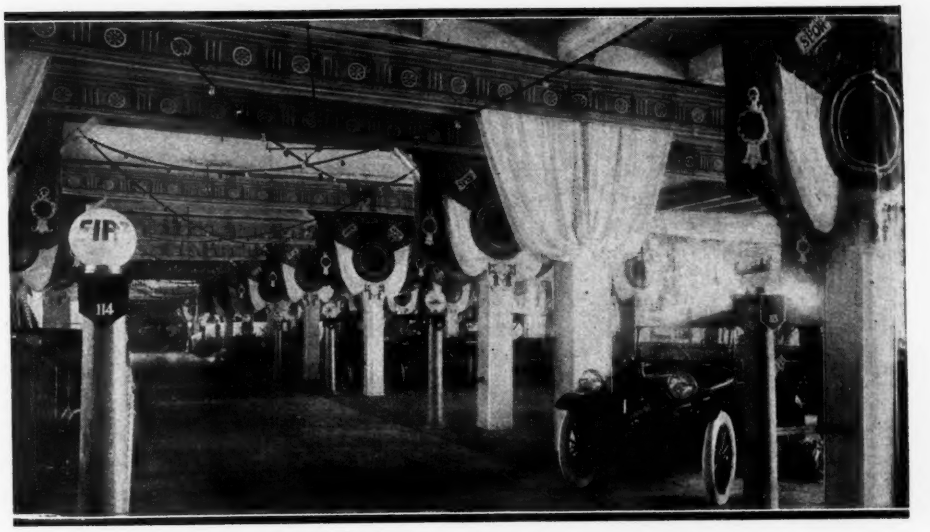
The Boston Automobile Dealers' Assn., an organization of approximately forty-five car dealers, which conducts the show, was, on being boycotted by the Motor and Accessory Assn., compelled to look about for accessory exhibitors and has succeeded in getting together a good representation of New England companies marketing varied forms of accessories. Many of these make new devices for small cars, there being an overwhelming exhibit of starters, and other devices made especially for Ford machines.

Factory Machinery a Feature

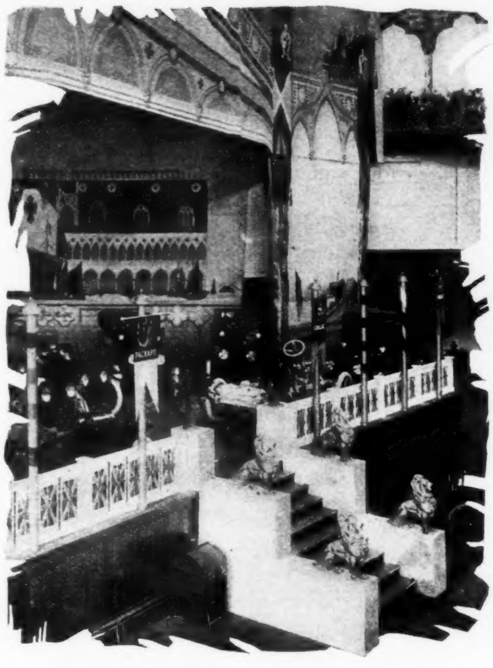
In the basement is a most creditable exhibit of factory machinery, including multiple spindle drills, broaching machines, 42-inch lathes, drills, grinders, etc. These machines are all running under electric power and machining materials the same as they would do in a factory. Unfortunately the attendance in these spaces is very small, and it would seem that exhibits of this nature are more suitable for a national show attended by the various factory officials rather than a local show of dealers.

There is a goodly exhibit of motorcycles, some motor boats, and the management has gone still further and filled up with clothing, clothing materials, notions, and other exhibit spaces more suited for a bazaar, but which may have a legitimate space in a show staged primarily for dealers and private owners. There is considerable vacant exhibit space in the basement.

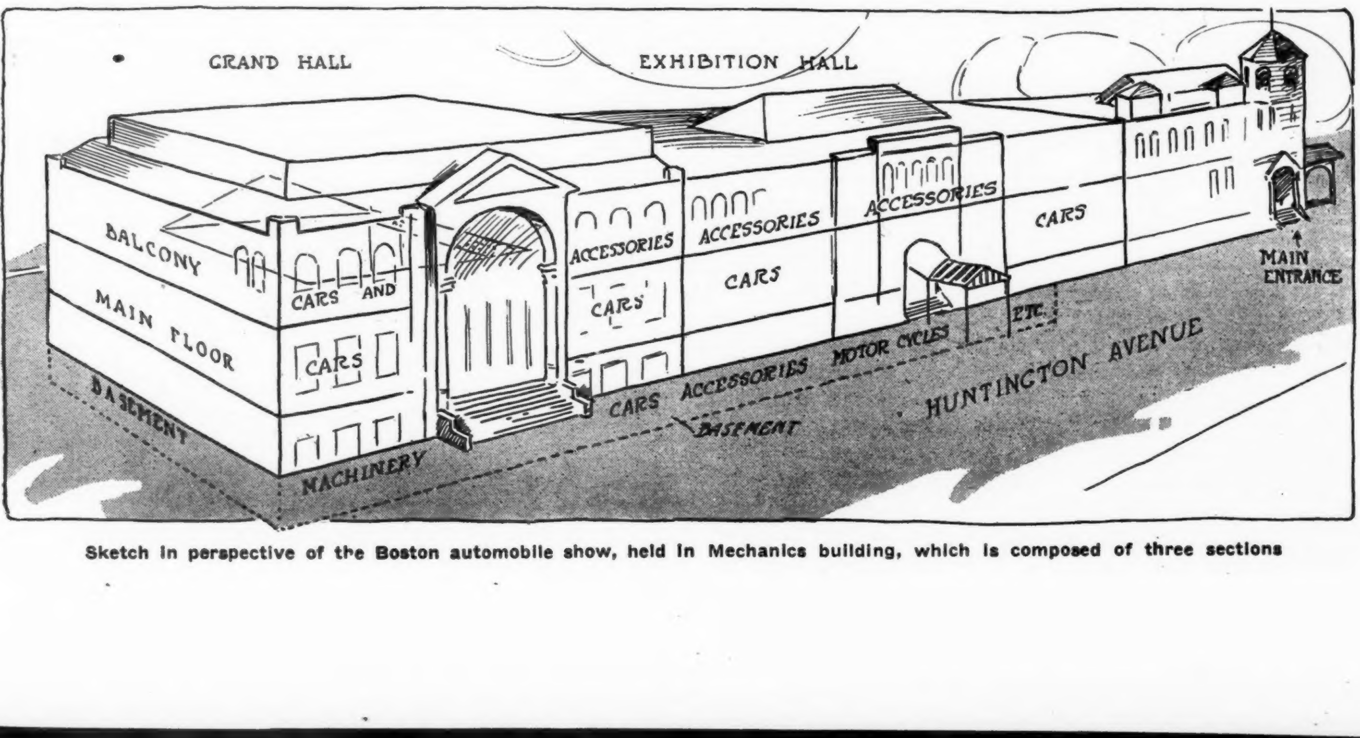
With the show but little more than well under way it is impossible to estimate what will be its buying possibilities. From a dealer's point of view it goes without question that it will be a success. Every New England dealer worthy of the name will be present.



A view in Mechanics hall, looking toward the south



Stairway of lions to stage in Grand hall



Sketch in perspective of the Boston automobile show, held in Mechanics building, which is composed of three sections

Representation of the Grand Canal in Venice, a part of the decorative plan

With him will come nearly all of the sub-dealers of the six states. These dealers look upon show week as the occasion of their annual visit to the Hub; they combine a visit to the show with that of annual purchases in other lines of merchandise in the city, in a word, this show week is becoming more and more a New England buying week in Boston. The show authorities deserve congratulations for so working up this automobile sentiment and using it as a basis of bringing buyers to the city.

Season Passes for the Dealers

The usual inducements are offered to dealers attending the show, namely, they have been invited by the show management to present their proper credentials at the official headquarters where they will be given a season pass. Visiting dealers and sub-dealers who handle cars other than those on exhibition are not granted these privileges, which must be looked upon as a mistake on the part of the show management because it is generally not the fault of these dealers or sub-dealers that their particular make of car is not on exhibit. There are naturally many of such dealers because a canvass of the list of makers of gasoline automobiles, as published in the annual specification tables in THE AUTOMOBILE for January 1, shows that there are seventy makes of more or less important cars not represented at the Boston show. To this list can be added the names of several passenger electric vehicles.

Injudicious Distribution of Tickets

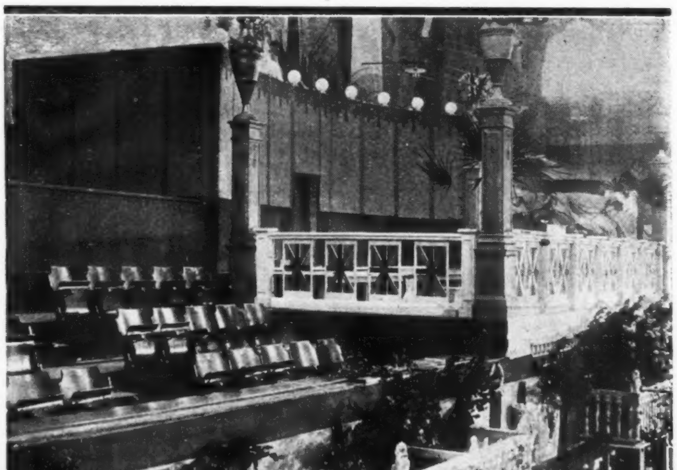
If one can judge from the attendance on opening night it would seem that both show management and dealers are continuing the old error of giving away admission tickets broadcast. Today two or three dealers frankly admitted that opening night was a failure so far as show business was concerned and that it only serves to give the curious a chance to look and carry away catalogs. There seems to be a continuance of promiscuous distribution of show admission tickets by dealers who buy these tickets in quantities at 25 cents each, as compared with 50 cents, the general price of admission. So glaring has this abuse become that industrial houses have grown sufficiently bold to write dealers for large supplies of admission tickets. Letters were shown from one insurance company in which it sent a letter broadcast to all dealers asking for tickets. There were other examples of where cashiers of banks were asking for tickets advancing the excuse that they had extended accommodations to some dealers, whereas, as a matter of fact, such accommodations had not been extended, the bank only acting as collection-agent for the deposits sent from the dealer to the manufacturer.

Boston dealers are buying these tickets in large quantities, rumors being that some will spend as much as $500 in this way. Were these tickets judiciously distributed it would be commendable enterprise, but their distribution will be promiscuous as heretofore and much of their value consequently lost. Some dealers are only sending such tickets to their present owners, which is good policy. In contrast with this, are many concerns sending them to everyone purporting to be a prospect.

Several dealers reported good inquiries both yesterday and today and look for as many retail sales as in former years, notwithstanding the fact that New England is shorter of money than in many years past because of the losses of dividends in the New Haven and Boston & Maine railroads. Then, too, there have been troubles with labor in the big textile centers and these have cut down the surplus cash in many sections. In spite of the retrenchments that must follow on such conditions, the dealers anticipate a good spring opening, but in the same breath they acknowledge that money has been very tight for months, but that a change for the better set in 3 weeks or a month ago.

Trading Policy Distracting

Unfortunately New England is badly distracted with the trading policy in making car sales. Nearly a dozen dealers today acknowledged that over 75 per cent. of their sales are made on trades, and where there are branch houses the valuation on old cars is often so high as to make it nearly impossible for the dealer to compete with them and show a symptom of a profit. As a result of this there are too many changes among Boston and New England dealers. Each year brings its tidal wave of new agencies, an agent tiring of one account and changing to another, his performance being but a jump from the frying pan into the fire, as a few dealers put it. In a word motor car merchandising is not on as high a standard as it should be.



Bandstand and decorative design on the side walls

One of the broad aisles in Mechanics building, looking north. Note exhibitors' signs on posts

Boston has always boasted of its decorations and as usual has right to high honors in this respect, for the decorative feature is a suitable one and is well balanced throughout the maze of buildings and rooms that house the cars and accessories. Before attempting to describe the scheme keep in mind that the Mechanics building in which the show is held is a right-angle triangle with a long base and a perpendicular about one-half this. This building is in reality two, although to all intents and purposes one. It is two in that about one-third of one end is cut off and forms what is called the Grand hall and which is separated from the remainder by thick walls with suitable doors leading through. The other hall is known as Exhibition hall.

This triangular building is three stories with a basement, a main floor and some second floor and gallery spaces. The main floor is all given over to cars; the basement is half cars and the remainder motorcycles, accessories and machinery; and the balconies and second floor are accessories and a few cars.

Entire Scheme Is Venetian

The entire decoration scheme is Italian. The Grand hall is Venetian and the exhibition hall Roman.

Grand hall is a huge rectangle with a stage at one end and a gallery around three sides. The Venetian scheme is worked out by the entire stage setting being a Venetian building scene and the opposite end of the hall shows the Grand canal, Venice, with buildings along each side of it. Along the face of the gallery are small Venetian balconies filled with flowers. From the ceiling are suspended huge chandeliers festooned with ropes of vari-colored lights. The entire effect is pleasing.

In Exhibition hall the Roman scheme of decoration consists of entablatures in the Roman style which conceal the massive beams supporting the ceiling. Masking pieces cover the pillars and the walls are decorated with large paintings of motor scenes. At the corner of each exhibit space stand plain Roman pillars with an illumined frosted globe on top, the globe carrying the name of the exhibit.

A view of the accessory displays on the back balcony

Big Summer Races for Le Mans

PARIS, Feb. 27—Le Mans will this year hold a 3-day automobile speed carnival, second in importance only to the French Grand Prix. On Saturday, August 15, the Automobile Club of France will run its annual motorbike race on the outskirts of the town made famous by the late Wilbur Wright. The following day a light car race will be run over the same course, and on the Monday there will be a second edition of the French Grand Prix for cars of not more than 4 1-2 liters cylinder area.

The light car race is an entirely new move. It is limited to machines having a cylinder area of not more than 85.4 cubic inches, and weighing not less than 770 nor more than 1,100 pounds empty. The limits exclude pure cyclecars, according to the European definition, but provide for the small, cheap, light machines which are becoming immensely popular throughout France. Each car must carry two men seated side by side, but the mechanic's seat can be 9 inches to the rear of the driver. The course selected is a triangular one a few miles to the south of Le Mans, and claimed to be the fastest in France. It was on this course that Bablot on Delage established a world's record of 82.5 miles an hour for one lap during last year's race.

The big car race, to be known as the Grand Prix de France, will be run on exactly the same lines as the Automobile Club race at Lyons, the maximum cylinder area being 274 inches.

Sicily to Have Two Races in 1914

PARIS, Feb. 20—Sicily will have two automobile races this year. The Targa Florio will be an 800-mile two-day race right round the island, starting from and returning to Palermo, and following the coast line the whole way. The date selected is May 25 and 26. Practically any type of car can be entered, for the maximum cylinder area is 549 cubic inches. It is practically impossible to make a good showing with a motor of this size, for the course is a succession of hills with dangerous hairpin turns.

The second Sicilian race will be the Coupe Florio run on the Madonie course, not far from Palermo, on June 1. The course is 93 miles round and has to be covered three times.

Methods of the French Designer

National Character and Working Conditions Affect French Automobile Product—Drawing Office Methods Are Thorough—Manufacture by Jig Not So Pronounced as in American Practice

EVERY American maker suffers more or less because, as the saying goes: He must do some of his most important work with his left hand; in a word, the maker does not produce the steel; he does not make the forgings, nor does he make the units composed of these parts, at least in numerous examples of products to be had on the market: He produces with his left hand, or, as a direct statement of the facts, he collects his scattered resources through the good office of those who appear to be able to cater to his needs.

To a certain extent the French maker is similarly situated, but there are specific differences to be observed. In France it is not unusual for the producer of the steel to make the forgings. The direct benefit to be derived from this combination lies in the ability of the producer of the forgings to deliver, in his capacity as steel maker, proper grades of steel for forging work, and, in his capacity as forging producer, to demand, of himself as steel maker, the desired grades of steel. If, by some misadventure, a given heat of steel proves not to be suitable for forgings, what is simpler than for the steel maker to requisition a new heat of steel; one that will conform closer to the given requirement. To the extent that the French maker of automobiles gets his forgings from the mill wherein the steel is produced and the forging work is done, that maker is happy even though not in full control of his factors and his results are accordingly improved.

But if it is true of the French maker that he is in a position to take advantage of certain desirable combinations of which the above is an example and, instead of starting to build his automobile before the drawings are made and prior to the completion of a tryout model, he finishes his drawings, then he builds his tryout model, after which he tests that model almost to destruction, and he ends up by revising the drawings, all before any attempt is made to build any such models for the market.

The French maker does not look upon his chief engineer as a staff to lean upon. He merely commissions his chief engineer to design a model for tryout purposes. The engineer is not licensed to play fast and loose with the maker's reputation to the extent of inflicting a poor model upon the maker's clientèle!

Fence in the Engineer

The maker recognizes the engineer's limitations. No man can fairly be put to the test of making all successes. It would not be fair to the engineer to ask him to whip an idea into shape for a tryout, and, at the same time to tell him that it must conform to a high ideal! If the engineer must make a success, then, to map out the road over which he must trudge is to hamper him at every step. Conceive a board of directors asking the engineer to make a 30-horsepower model, using a two-cylinder, air-cooled, two-cycle motor, a planetary gearset or a friction set, a single sprocket to a live rear axle and 28 by 2½ tires on wire-spoked wheels. Also, in order that the automobile may be of the greatest simplicity, use a coil ignition system with six dry cells to furnish the electric current, and, for lubrication, place the lubricating oil with the gasoline in the tank. More than one engineer has listened to more fatal orders than these.

Why, then, in view of these facts, is it fair to say of French makers that they, the engineers, get short shrift in the consulting room? Money for investment purposes is not so easy to get in France. Those who command investment money must have a reputation for conservatism that the engineer cannot afford to tamper with at all. Were an engineer of France placed in the dual position of having to assure, not only the integrity of an investment but, dividends also, and then, on top of all, were he required to go to market with 10,000 absolutely raw automobiles, he would repeat *"il n'est pas bon"* one thousand times and then he would go and jump in the river!

French Tryout System

It is fairer all round to say to the engineer: "Our present models of automobiles are getting *passé*. Next year we must be prepared to conform more nearly to the newer market conditions. Go to work on the drawings of a revised model along the lines indicated by our records of experience and submit something definite for the consideration of the board of directors."

When this phase of the problem is duly past, then it is for the board to add: "Make three or six tryout models as per drawings submitted and marked Accepted 12/7/13, one to be tried out on the road; one to be tried out by the directors and one to be tried out by the chief engineer, etc., and all to be fully reported upon in due course.

With the effort thus far progressed, to correct evils and to revise drawings is the natural sequence. After which, it is for the directors to authorize a shop order of the cars, not, however, without duly considering not only the probable demand of the market, but the balance of stock of old models in hand to be disposed of before they may be eclipsed by the new model contemplated to supplant the *passé* model. Of course, the directors may say, as has been frequently done in the past, "mark any remaining automobiles after the new model comes out: Colonial for Export; and we will get them off our hands in this way!"

French Labor a Factor

In a certain sense French-made automobiles are the crystals of slow growth and coupled with this advantage there are certain negative conditions to cope with. French artisans are required to work through long days at a low hourly rate. The result is that, if they make a fair living, it is at the cost of putting in nearly half of each whole day to get it. It will be seen too, that, by virtue of long days' work, the workmen get much practice at their work. The result is that, they are as proficient as close application to the operations for long hours at a time can possibly make them.

French-made automobiles are bound to reflect the characteristics of French labor conditions. The cars are, as a rule, well fitted. True, in the sense that this matter is viewed in American plants of the best examples, there are no two French cars alike! The very minute that a draw-file contacts with a surface, so far as accuracy of fit from the point of view of a standard is concerned, that fit is destroyed! The French have simply acquired the art of making a limited number of well-fitted automobiles.

In comparison with the French, it must be said of American practice that quantity took precedence over quality. In this connection, however, accuracy in the American plants that are known to favor it, is a deliberate question of designing—the

limits of tolerance are fixed by jigs, tools, and fixtures. In the French cars, on the other hand, each car has individuality. This property creeps in, reflecting the accuracy of the individual.

Art in French Design

It is on account of the large amount of hand fitting that is done on French-made cars that simple shapes of the parts used are favorable to a low cost. It is fortunate too, that, from the art point of view as it relates to questions of utility, that which looks good to the eye of the artist generally proves to serve well and faithfully in practice.

A first-rate French draftsman, when he is set to the task of laying out a part, is likely to draw in all of the related centers first; then, free-hand, he may sketch in the part to be made, making it conform to his eye-sense of art appearance; after that, he calculates the required strength of section and slightly modifies the free-hand drawing to suit strength requirements. It is a process that may readily be conducted without destroying art-appearance. In nine cases out of ten, the good draftsman will come so close with his original sketch that, when the check calculations are completed, the part will scarcely have to undergo any modification at all.

Twenty-Six Drafting Rules

There are certain rules of the French drawing office that govern the draftsman like bands of steel. They are:

1—*Never use a part in any situation such as will require it to suffer in a dual capacity.*

2—*Never detail out a part until it is clearly shown in the general drawing.*

3—*Never make a general drawing that cramps the space required for any of the members in its makeup.*

4—*Never be content with a general drawing that shows the necessity of putting an offset in even a single member in its makeup.*

5—*Never sacrifice clearance to strength of parts.*

6—*Never build up, one part upon another, in the process of assembling.*

7—*Never interlace units. Each unit in turn should have its own undisputed place.*

8—*Never connect units direct to units, put an accommodation member between the units.*

9—*Never countenance a left-handed assembling undertaking. So contrive that, in dis-assembling endeavor, a free field and no favor will govern the whole undertaking.*

10—*Never fall into the fallacy of thinking that, if a member when designed proves to be frail, the difficulty may be surmounted by the simple, expedient of substituting a better grade of material. So long as the Modulus of Elasticity remains nearly constant for all grades of steel from the very best to the very worst, failure threatens the plan.*

11—*Never put in time trying to compromise a shape on the score of mere cheapness; use every effort to contrive simplicity of form and broad utility of purpose.*

12—*Never put up with an incongruity of design. If necessary, start all over again, but get rid of the fester while yet the design is on paper. It is easier to cut paper than it is to bend steel!*

13—*Never sacrifice appearance. If a part fails to please the skilled eye it conceals a fault. Get rid of that part.*

14—*Never say that anything is all right unless, by inspection of the drawings, it is conclusively clear in three views.*

15—*Never trade a certainty for an uncertainty!*

16—*Never toy with an innovation—keep to the middle of the road; let the experimental department first conclude all of its research work.*

17—*Never shy at the use of a good idea just because you know of some person who used it before your time.*

18—*Never be satisfied with a device if, in your judgment, it may be severely criticised. You are bound to be relatively blind. If you can see anything at all the matter with your idea, some outsider will find a round dozen of good arguments against its use.*

19—*Never design ahead of your market. If a market wears knickerbockers, make a knickerbocker design.*

20—*Never hold a secret against your superior in designing work. Take him into your confidence. Let his rounded-out judgment have a chance to illuminate the subject.*

21—*Never continue work on a drawing 1 minute after you lose faith in the plan—it is fatal to the undertaking.*

22—*Never side-step a problem. To ignore a thing if it is likely to give trouble, transferring the attention for the time being to some task which is more agreeable to contemplate, is to risk success—the unsolved, neglected problem may hide away long enough to permit it to permanently take up its abode in the finished article.*

23—*Never let a day pass without jotting down in a book, kept handy for the purpose, such good ideas as may come to the surface apropos of the work in hand.*

24—*Never permit yourself to get into the mood which may cause you to feel dissatisfied with the work that may fall to your lot to do, on the ground that you are playing a too inconspicuous part. An automobile will fail in service for any cause as readily as for any other cause; it is for you to remember that all parts are of equal importance, because each part represents a link in the chain of the design.*

25—*Never fail to remember that the lines you show on paper have to be cut by steel on steel before the undertaking is completed, the latter operations are the more difficult and costly.*

26—*Never forget that a jig or a fixture must be provided for every part before it can be fashioned out of metal. If the design is simple, the fixture will have this property also but not otherwise. Then, too, simplicity makes for good all along the line, more particularly in the completed automobile.*

Minor Devices Recently Introduced in Europe

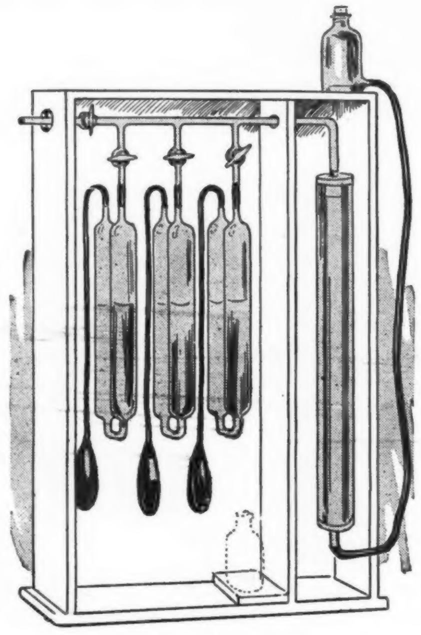
THE use of hardened steel balls as calipers, mainly for measuring bores, have been placed in the German market through the Riebe ball-bearing and tool works of Berlin. A ball of the required size, within .001 millimeter, is ground off in one place so as to remove a segment excepting a central stud. A flanged ring is pressed onto the stud, the flange abutting against the base of the segment and a tubular handle is pressed upon the ring. The advantage over cylindrical calipers lies in superior hardness, the distortion of chrome steel balls being small, cheap production through established ball-manufacturing methods, self-centering in the bore to be measured, easy handling, small wear, robustness and accuracy. Bores measured by this tool do not vary more than .002 to .003 millimeter, it is said, and tolerance calipers therefore become unnecessary. The application to interior length measurements is less obvious. For this purpose a number of balls are placed in contact within a tube the ends of which are compressed to hold the end-balls while allowing them to project. The accuracy of this type comes within .02 millimeter. Mr. Riebe, director of the company offering this device, recently made a tour of American automobile factories.

A manufacturer at Strassburg offers a tire inflation pump comprising a cylinder with a handle at each end and a shaft, by which the two pistons are worked, projecting at a right angle from the middle; also a pressure gauge. This shaft is held into engagement with the front end of the motor shaft, a special starting crank being first fitted to the motor to permit this to be done, and thus the motor sends air through a rubber hose to any of the four tires, the man doing nothing but holding the pump.

Engineers' Forum

Greatest Value Is Detection of Erratic Carbureter Action

Some Views on Exhaust Gas Analysis and Its Worth


The Orsat apparatus

Part I

By Arthur B. Browne

Next week Part II. of this discussion will appear, containing the views of David Fergusson, W. C. Marshall, C. W. Stiger and others.

BRANFORD, CONN.—Editor of THE AUTOMOBILE:—The performance of an automobile engine presents problems of a physicochemical nature. Because of the complexities of the interrelationship of these two branches of science, the chemical investigation of combustion reactions and their physical effect on power output has registered less progress than its importance deserves. This seems due in large measure to a lack of understanding cooperation between chemist and physicist and it is therefore gratifying to note the comprehensive scope of the article on Exhaust Gas Analysis in recent issues of THE AUTOMOBILE.

Primarily, power is developed in the internal combustion engine as the direct effect of heat, liberated solely by means of certain chemical reactions known as combustion. Knowledge of these reactions is therefore of prime importance. Because combustion takes place, after a fashion, throughout such a wide range of mixture composition, engineers are prone to lose sight of the necessity for a careful study of these fundamental reactions, even though they form the very basis of power development.

Gas Analysis the Best Method

There is at present no better way of obtaining this necessary information than through the medium of exhaust gas analysis. That the results of gas analyses have seemed inconsistent at times, is due rather to improper interpretation of these results than to any inherent fault in the results themselves. It must be admitted that gas analysis has not yet reached the point where complete information may be obtained but with the well known methods in common use, sufficient data may be obtained which, when properly interpreted, will be found wholly consistent and in point of fact, sufficiently accurate for all practical purposes.

One of the most important uses of exhaust gas analysis is for the determination of the relative proportions of fuel and air which are present in the mixture. That this can be very closely approximated from the composition of the exhaust gases seems well established. Dr. Watson's curves shown in Fig. 2 of the article by Herbert Chase in the recent issue of THE AUTOMOBILE, are available only when the exhaust consists of either CO_2 and O_2 or CO_2 and CO. When both O_2 and CO are present, the air-gas ratio may be determined by use of the formula given by Clerk & Burls in The Gas, Petrol and Oil Engine, Vol. II, page 632, as follows:

$$\text{Corrected } \frac{\text{Air}}{\text{Fuel}} \text{ ratio by weight} = \frac{2.86\,N}{0.532\,N - 0.4\,CO - 2\,(CO_2 + O_2)}$$

In this formula the chemical symbols are used to represent the volume per cent. of the gases and the co-efficients are based upon an analysis of the fuel which was, in the case cited, C = 85.2 per cent. H = 14.8 per cent.

In determining the nitrogen by difference account must be taken of the presence of free H and CH_4 which are not ordinarily determined. Ballantyne has shown, however, that these constituents bear a constant ratio to the percentage of CO present in the following proportions:

Per cent. of free H = 0.36 per cent. of CO
Per cent. of CH_4 = 0.12 per cent. of CO

On page 631 of the same volume is shown comparative results of the formula from which the foregoing is derived, with results of actual measurements by Dr. Watson. The agreement is sufficiently close for all practical purposes, particularly if a numerator of 2.7 N is used when the ratio is 10 to 1 or less.

Applying this formula to the analyses of the exhaust gases in the tests recently conducted by THE AUTOMOBILE, we find remarkable variations in the mixtures, not only in different cars but in the same car under different test conditions.

Fig. 1 shows this variation in cars 1, 2 and 3, the different test numbers being plotted as abscissae while the air-gas ratios appear as ordinates.

Dr. Watson, Proceedings I. A. E., Vol. III, page 405, has determined that maximum power is developed with an air-gas ratio of from about 11 to 13, while maximum thermal efficiency occurs with a ratio of about 17. Hopkinson and Morse, *Ibid* 284, show that maximum thermal efficiency and maximum power occur practically together at a ratio of about 14. Experiments of the Massachusetts Institute of Technology show maximum power development with a ratio of about 12, which is in practical agreement with Dr. Watson's results. The Royal Automobile Club has decided that the Best Mixture is at a ratio of 14.5 as giving from 90 to 95 per cent. of both thermal efficiency and maximum power. This is in reasonable accord with the determinations above cited.

The lines of maximum thermal efficiency, maximum power, with some sacrifice of fuel economy, and the R.A.C. standard, have been plotted in Fig. 1 and even casual inspection of the diagram will show how far the cars under test departed from ideal conditions. The reason for the relative fuel mileages of the cars is also apparent. The diagram also shows the erratic carbureter action to which the engines were subjected.

For instance, had the carbureter of Car No. 1 maintained throughout the test anything approaching the constancy it exhibited in tests 2 and 3 its fuel record, already good, would have been greatly improved. Had the carbureter of Car No. 3 maintained its same constancy with decreased fuel, this car would have, in all likelihood, surpassed the performance of Car No. 1 both in fuel mileage and general smoothness of operation.

Complete combustion is possible only in the presence of *sufficient* air in *intimate admixture* with the fuel. Maximum pressures are obtainable only within very narrow limits of mixture composition. Both are essential to efficiency.

Fig. 2 is a chart plotted from a tabulation of experiments

of the Massachusetts Institute of Technology. The time in seconds required for the explosion pressure to reach its maximum is plotted against air-gas ratios by weight. The maximum pressure in pounds per square inch appears against each point plotted.

Inspection of this chart shows that the greatest pressures are obtained when the rate of burning is fastest and that departure from the line of quickest burning either toward richness or leanness means a rapid falling off in power. It is true that by a proper spark advance this loss of power may be compensated for to some extent but even an automatic spark control would have to be nimble to follow the varying ratios in Fig. 1.

CO Indicates Direct Fuel Loss

As Mr. Chase has so ably stated, CO in the exhaust indicates in itself a loss as direct as if the gasoline tank leaked. This loss is readily understood when we consider that 1 pound of carbon burned to CO_2 liberates 14,600 BTU, while 1 pound of carbon burned to CO liberates only 4450 BTU or but a little better than 30 per cent. of the contained heat. The loss thus sustained is not in direct proportion to the CO present as is sometimes stated, but is rather a function of the CO_2/CO ratio. A convenient formula is given by Clerk & Burls for determining this loss. Slightly modified to use the lower heat value of the fuel this formula is

$$\frac{0.7}{1.03 + \frac{CO_2}{CO}} = \text{per cent. of heat lost.}$$

Applying this formula to the cars under discussion we find the average losses to be as follows:

Car No. 1 = 6.7 per cent. loss.
Car No. 2 = 23.0 per cent. loss.
Car No. 3 = 30.00 per cent. loss.

There are certain features of relative throttle opening reducing compression pressures, with resulting diminution of fuel efficiency which compensate these figures slightly, but this quantity is quite negligible in the present consideration.

One Theory Generally Overlooked

The foregoing losses are the direct result of the presence of CO and exist *because of it.* CO furthermore is, ordinarily, an *indication* of an over-rich mixture with all the losses that condition entails. This is not always the case, however, particularly when CO is present in small quantities and even more obviously when it is associated with free O_2. The latter condition has excited much scientific speculation. That it is due largely, but not wholly, to imperfect contact of the molecules of fuel and air the writer has demonstrated to his entire satisfaction. Claims have been made that liquid fuel particles actually passed through the cylinders unburned or but partially burned. This is more difficult of credence but not impossible. There is, however, one theory which seems to have been generally overlooked but which, if it is ever established, will demand serious consideration on the part of the designer. Some years ago MM. Mallard & LeChatelier demonstrated in a glass container that during a certain phase of concussive flame propagation, the flame was extinguished before combustion was complete. This they attributed to an action not unlike the echo of a sound wave. The vibratory character of flame propagation through an explosive mixture is commonly accepted and it would seem possible that only a slight accentuation would be necessary to cause vibrations which might extinguish the flame. A careful study of this phenomenon might lead to distinct progress.

Unfortunately exhaust gas analysis tells us *what* but not *why,* but if this method of investigation served no other purpose than to detect erratic carbureter action, which it certainly does most efficiently, it would merit the close attention of every testing laboratory.—Arthur B. Browne.

Fig. 1—Diagram showing the variation in cars 1, 2 and 3 of the exhaust gas analysis tests, the different test numbers being plotted as abscissae, while the air-gas ratios appear as ordinates. Note the varying ratios of air to gas

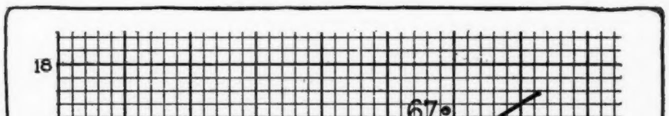


Fig. 2—Chart plotted from a series of experiments of the Massachusetts Institute of Technology. The time in seconds required to attain maximum explosion pressure is plotted against air-gas ratios by weight

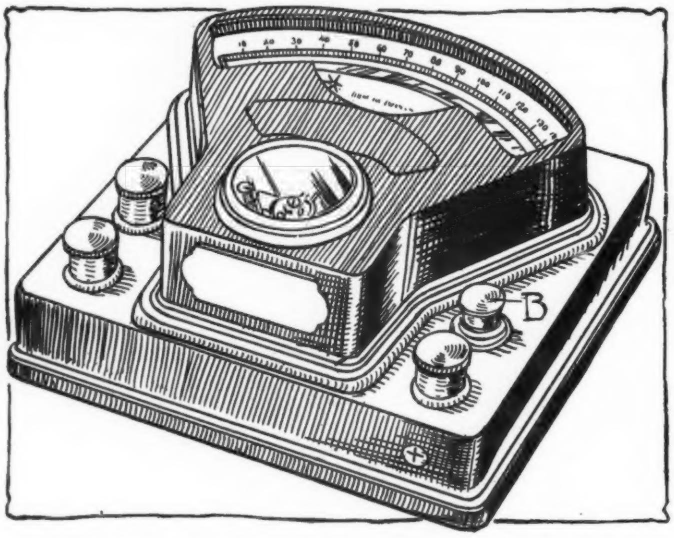


Fig. 1—General view of complete portable two-scale voltmeter mounted on base with terminals and push button

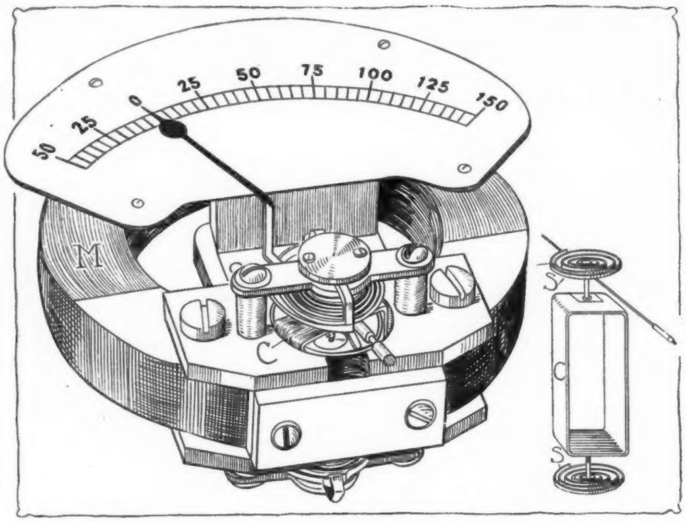


Fig. 2—Moving system of D'Arsonval instrument, showing moving coil C to the top of which the needle is attached

How Electricity Is Measured

Voltmeter and Ammeter Design and Construction—Principles of Action of D'Arsonval Moving-Coil Instrument—Use of Shunts

By Joseph B. Baker

TO external appearance the voltmeter is a box with two or more binding posts for connecting the instrument to an electrical circuit the voltage of which is to be tested with a scale (protected by a glass) over which sweeps a pointer, Fig. 1. When the connection is made to the instrument—as by pressing a button B on the instrument base—the pointer moves from the 0 position on the scale to a figure indicating the voltage. The pointer is actuated and carried by a moving system within the instrument case.

In Fig. 2 are shown the essentials of a D'Arsonval voltmeter. The view at the left shows the complete switchboard instrument removed from its case while the detail sketch shows the moving system of a portable instrument. The moving system consists of a coil, C, of insulated wire, pivoted free to move radially in a fixed magnetic field given by a powerful steel magnet, M, and carrying the pointer, at its upper end. The angular movement or deflection of the moving system is due to the reaction between the magnetic field of the steel magnet and another magnetic field generated by a current passing through the moving coil, and this deflection is proportional in amount to the voltage at the terminals of the coil. The higher the voltage of the electrical circuit connected to the binding posts of the instrument, the stronger the current flowing through the pivoted coil and the greater the deflection of the pointer on the scale.

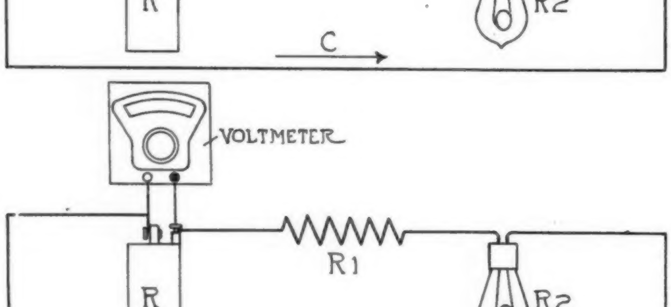


Fig. 3—Diagrams illustrating passage of current in simple circuit, including two external resistances, and method of connectng voltmeter to show fall of potential across battery terminals

The moving system is exceedingly light, and is pivoted at top and bottom in jewel bearings. The coil must be permanently connected in circuit, yet free to move. Very light spiral springs S, Fig. 2, are therefore employed as terminals for the moving coil. These springs maintain a perfect electrical connection between the coil and the instrument wiring while permitting the coil to be deflected through a wide angle by the very small force of reaction between the two magnetic fields.

The steel magnet is fastened flat on the instrument base, and the scale of cardboard is mounted at the back, as shown. The scale, plotted on a circular arc with its center coinciding with the center line of the jewel bearings, is calibrated in volts by comparing the scale readings with laboratory standards.

With this essential magnetic and mechanical construction of the voltmeter clearly in mind, we may now take up the electrical winding of this instrument.

Voltmeter and Ammeter Differences

In appearance, a voltmeter and an ammeter are much alike, but the former is wound so that it takes a very small current from the circuit to which it is connected, and it is connected to the circuit in parallel; whereas the latter is wound so as to take the whole current flowing through the circuit to which it is connected, and is connected in series. The reason for this difference of connection will become clear by examining briefly the fundamental law which determines the electrical pressure,

known also as electromotive force, or difference of potential, required to force a continuous current of given strength through a conductor of given electrical resistance. This law is known as "Ohm's Law," and may be expressed by the formula $E = C \times R$, that is, the electromotive force (e.m.f. for short) in volts in any electrical circuit equals the product of the current in amperes, times the resistance in ohms.

Let us consider the simple electrical circuit, upper diagram, Fig. 3, consisting of several resistances, viz., the dry cell R, the coil R_1 and the incandescent lamp R_2, connected in series, and through which the current C is flowing. Suppose it is required to ascertain the voltage at the terminals of one of these resistances R, that is, the fall of potential E in same. Using the above formula, this voltage equals the product of R and whatever value C may have. The larger the current passing through R, the larger will be E, and the smaller the current passing through R the smaller will be E. If connecting the votage-measuring instrument were to cause a change in the current through R the value of E would be changed. But by making the resistance of the voltmeter high, and connecting it to the circuit in parallel, as shown in the lower diagram, the very small current taken by the instrument leaves the circuit under test substantially unaffected; yet the strength of this very small current flowing through the voltmeter is proportional to the fall of potential in R and will therefore deflect the moving coil and pointer in like proportion.

Fixed Resistance Required

The winding of the moving coil must always be of many turns, in order to develop a sufficiently strong magnetic field to react with the main field of the steel magnet. But the total resistance necessary to have in the instrument in order to limit the current taken cannot usually be got into the limited space occupied by the moving coil. Therefore, a small part only of this high resistance is wound up in the coil, the remainder being in a fixed resistance coil contained in the instrument case as shown in the circuit diagram of a voltmeter of 0 to 150-volt range, Fig. 4, in which A and B are the binding posts of the instrument. If the instrument is connected, for example, to a 100-volt battery the fall of potential in the moving coil is a small percentage only of the total voltage at the binding posts; but since the current passing through the instrument flows through the moving coil and the fixed resistance in series the voltage at the terminals of the moving coil is always proportional to the total volts whatever its actual value may be as determined by ohms law, $E = C \times R$. If the total fall of potential in the total resistance of the voltmeter circuit (14,000 ohms) is 100 volts, the fall of potential in the moving-coil portion of the circuit must be $\frac{120}{14{,}000}$ of this 100 volts, that is, a little under 0.86 volt; and if the total voltage were 150 instead of 100, the fall of potential in the moving coil would likewise become 50 per cent. greater, or 1.28 volts. The instrument may therefore be calibrated for the voltage impressed at the binding posts.

This same electrical construction is also utilized in adapting a single instrument for different ranges, such an instrument being equipped with two or more scales, Fig. 5, laid out on the same card, as for example, in a voltmeter of 0-3 volts and 0-150 volts ranges. A deflection to a certain point on the scale means, say, 2 volts on one range, and means fifty times this value, or 100 volts, on the other range. The fall of potential through the moving coil alone is the same in both cases, for the pointer is deflected to the same place on the scale. But in the second case the reading is to be multiplied, by reason of the voltage drop in an extra resistance in the circuit of the moving coil, Fig. 6.

The circuit between the binding posts A and B, for the 0-3 volts scale, includes the main fixed resistance coil and the moving coil, while the circuit between the binding posts A and C, for the 0-150 volts scale, includes in addition, a comparatively high resistance auxiliary coil. In testing an electrical circuit connected to binding posts A and C, the position of the pointer is read on the upper scale the divisions of which have a value fifty times the value of the divisions on the lower scale.

Constructional Features

We may now take up certain concrete features of construction found in high grade voltmeters of the moving coil type.

The rectangular moving coil is wound up of silk-insulated copper wire of extreme fineness and mounted on a light aluminum frame which carries the pivots and the pointer. In a typical voltmeter for automobile use, a two-scale instrument reading from 0 to 15 volts and from 0 to 150 volts, the coil consists of 195 turns of No. 40 wire, B. and S. gauge, and weighs 3.48 grams with its carrying frame of aluminum, its aluminum pointer and its spiral-spring connections. The pointer is of aluminum wire. Its free end is flattened into a thin strip perpendicular to the surface of the scale over which it sweeps, so as to present a thin edge to the eye.

The electrical link between the moving system and the fixed

Fig. 4—Internal circuit of single-scale voltmeter, showing fixed resistance and moving coil

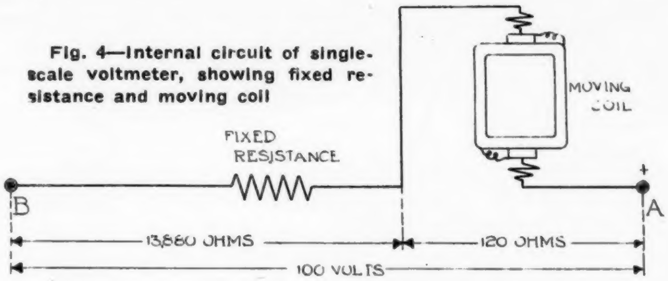
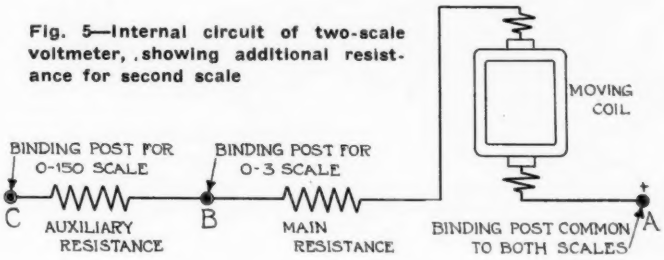


Fig. 5—Internal circuit of two-scale voltmeter, showing additional resistance for second scale



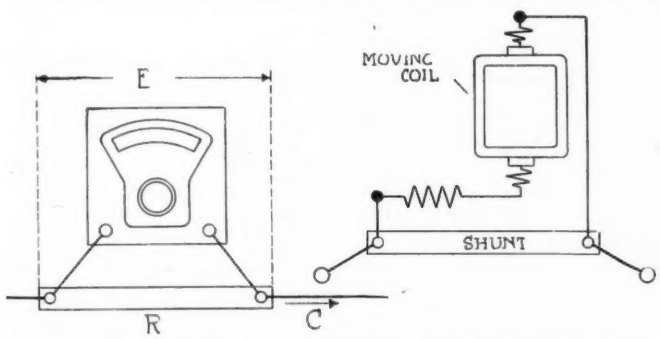


Fig. 6—Showing application of resistance shunt to terminals of ammeter to carry bulk of current

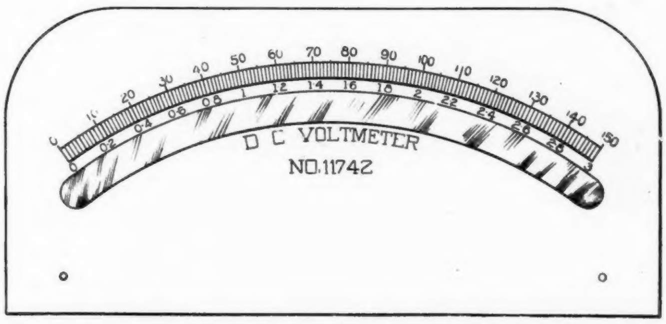


Fig. 7—Scale and mirror of double-range voltmeter reading from 0 to 3 volts on lower scale and 0 to 150 on upper

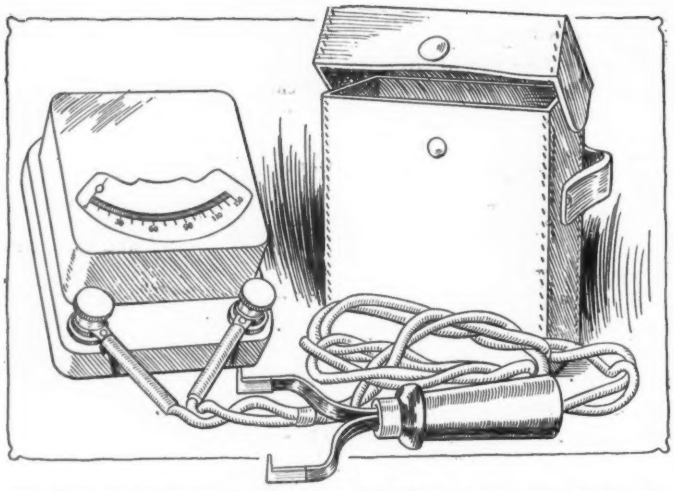


Fig. 8—Portable voltmeter set with flexible and prong contact handle for testing a vehicle battery

part of the instrument must obviously be one of great lightness and delicacy. The problem thus offered has been solved by the remarkably ingenious device, already mentioned, of allowing the current to enter and leave the pivoted coil through a pair of delicate spiral springs with open turns, one spring above and one below the coil; these springs being of non-magnetic but resilient metal (phosphor-bronze) in form not unlike the hair-spring of a watch on a large scale. The two ends of the fine-wire winding of the moving coil are soldered to terminals connected to the inner ends of the springs, and the outer ends of the springs are soldered to fixed, insulated brass terminal brackets mounted on the magnet pole-pieces.

Springs Oppositely Wound

This allows a high degree of flexibility in the electrical connection while providing a slight but definite and perfectly controllable force tending to retard the angular deflection of the coil due to the magnetic force of reaction between the field of the coil and that of the steel magnet. One of the springs is wound right-handed, and the other left-handed, so that the deflection of the coil from the zero position tends to close up the convolutions of one spring while opening out the convolutions of the other; the resultant effect being that the force opposed to the deflection of the coil remains nearly uniform in its retarding tendency throughout the full deflection. This differential arrangement of the pair of springs therefore helps to give the instrument what is known as a uniform scale, that is, approximately equal widths of scale divisions throughout for equal increments of voltage between the beginning and the end of the scale.

The stationary part of the voltmeter consists of the magnet and its pole-pieces, the fixed soft-iron core of the moving coil, the jewel bearings on which the moving coil turns, the scale, the base (to which the binding posts and the fixed windings and connections are attached), and the metal and glass cover. In many instruments a separate carrying case of wood or leather is also provided.

The jewel bearings are sapphire cup-jewels in the best instruments, accurately ground and polished. They are mounted in adjustable supports on the center line of the interpolar space of the steel magnet so as to support the coil on its pivots in position coaxial with the interpolar space.

The permanent magnet is one of the most important parts of the instrument. It is necessary to have this magnet not only powerful, but magnetically constant and unchangeable, and so designed as to give a field of uniform strength throughout the interpolar space, that is a flux of lines of magnetic force of equal density in every part of that space. To give the necessary strength and concentration of field the magnet is made of a high-grade special steel, bent into modified horseshoe shape and tempered, and then well magnetized by electrical means; and the necessary permanency is secured by artificially "aging" (by mechanical jarring and alternately heating and cooling) in the process of manufacture, which takes out the surplus magnetization and renders the magnet proof against the gradual weakening by lapse of time that would otherwise take place. A magnet of this design and material gives a strong flux of lines of force and the field is rendered uniform by employing soft-iron pole-pieces, firmly screwed or riveted to the jaws of the magnet with good magnetic contact, and bored out in true cylindrical shape, and by mounting a solid cylinder of soft iron in the center of the interpolar space. The diameter of this soft-iron core is enough smaller than that of the cylindrically bored out pole-pieces to leave a narrow annular gap for the moving coil to swing in. The moving coil closely embraces this fixed core, which is rigidly secured to the non-magnetic frame holding the magnet, the jewel bearings, etc., but without touching either the core or the pole-pieces; that is, there is a small clearance between the inner walls of the rectangular moving coil

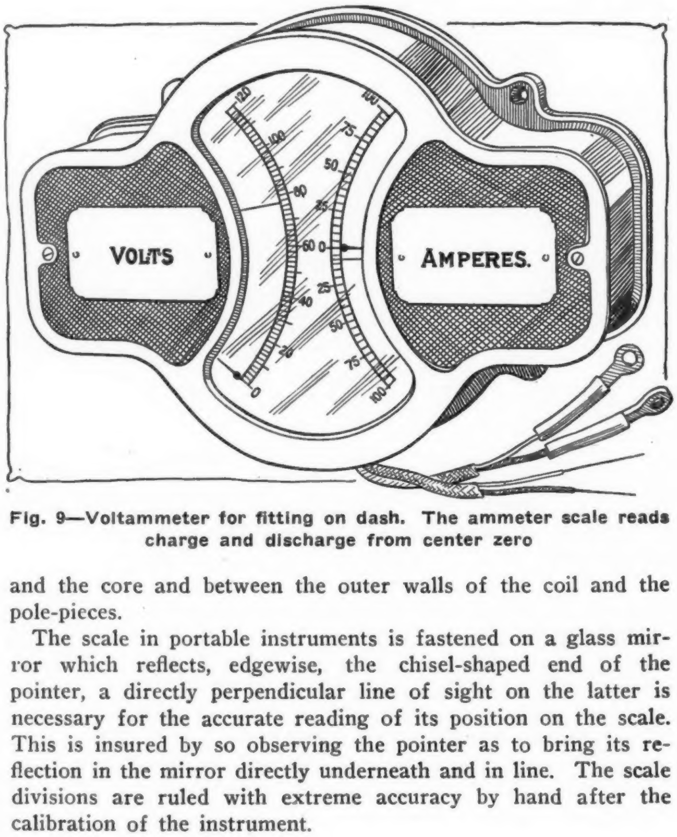


Fig. 9—Voltammeter for fitting on dash. The ammeter scale reads charge and discharge from center zero

and the core and between the outer walls of the coil and the pole-pieces.

The scale in portable instruments is fastened on a glass mirror which reflects, edgewise, the chisel-shaped end of the pointer, a directly perpendicular line of sight on the latter is necessary for the accurate reading of its position on the scale. This is insured by so observing the pointer as to bring its reflection in the mirror directly underneath and in line. The scale divisions are ruled with extreme accuracy by hand after the calibration of the instrument.

Terminal Covers Fitted

In the best makes of voltmeter the binding-posts are usually made with an outer shell of hard rubber to prevent risk of short-circuits by accidental contact between the posts and tools or other metal objects. The studs are spun over at the ends so that the thumb-nuts cannot loosen.

Instruments having two or more ranges ordinarily have the positive terminals of all the internal circuits soldered to a common and plainly marked plus binding-post, as shown in the general view, Fig. 1. The push-button switch in the base of portable voltmeters for connecting the instrument in circuit is usually so arranged that simply pressing it down closes the circuit for a momentary glance at the scale, whereas pressing it down and giving it a slight twist holds the circuit closed.

The cover is ordinarily of spun brass or aluminum fitted into a groove in the base and made dust-proof and moisture-proof by a felt gasket. The metal directly over the scale is cut away and fitted with a glass window, sealed dust- and moisture-proof. In many makes of high-grade instruments, both voltmeters and

ammeters, the cover is sealed to the base to prevent unauthorized tampering with the mechanism or connections, the makers' instructions to purchasers being to return the instrument to the factory for repairs and recalibration in case of any trouble.

Fig. 8 shows a small size single scale portable voltmeter of the D'Arsonval type designed for testing storage batteries.

Action of the Ammeter

Taking up now the D'Arsonval ammeter, it is to be noted at the outset that this instrument, designed for measuring current strengths, is identical with its companion instrument, the voltmeter, in having a fine-wire coil swinging on jewel bearings in a strong and uniform fixed magnetic field, pole-pieces embracing this coil, and a soft-iron core surrounded by the coil, and a pointer and scale. The one essential feature of difference in the instrument is the internal electric circuit, the instrument, although indicating current strength, being really a voltmeter for measuring the fall of potential through a known and low resistance.

Let Fig. 6 represent a circuit through which the current C is flowing. Included in the circuit is a metal bar having a low but precisely known resistance, R. In accordance with the formula $E = C \times R$ there will be a definite fall of potential in R, strictly proportional to the strength of current in same. A milli-voltmeter (that is, a voltmeter adapted to measure low potential differences, in thousandths of a volt) is connected to the terminals of R, indicating on its scale this fall of potential E. (Almost all of the current, be it understood, passes through R, known as the "shunt," since this is a very low resistance; only a very small part going through the milli-voltmeter.) Thus, if the current increases, the increased fall of potential in the shunt will be shown by a correspondingly increased deflection of the milli-voltmeter; and since E is always proportional to C, the milli-voltmeter's indications will follow exactly all variations of current. They in fact *represent* the current strengths

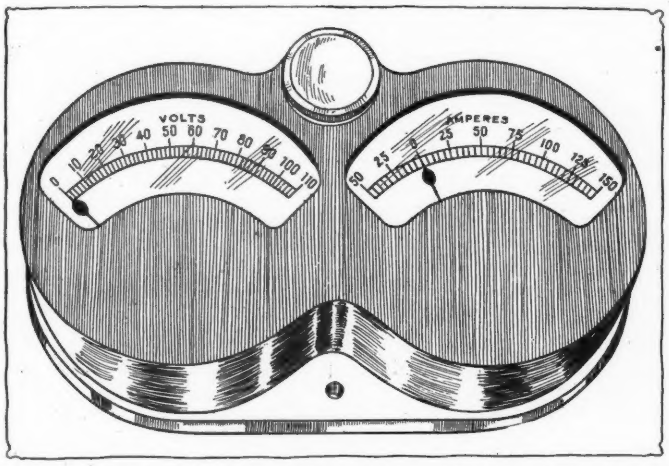


Fig. 10—Dashboard voltammeter with small incandescent lamp fitted inside to illuminate the scales

at every instant, so that the scale of the instrument may just as well be, and actually is, calibrated in amperes instead of in volts.

The entire circuit of the ammeter winding as actually constructed, is shown at the right, Fig. 6. The path from one binding-post to the other is directly through the shunt, a strip of resistance metal carefully calibrated; and from the actual terminals of this shunt a pair of wires leads to a complete voltmeter circuit incorporated in the instrument.

Just as the resistance of the voltmeter must always be high, in order that connecting that instrument *in parallel* to an electrical circuit will not affect the latter, so the resistance of the ammeter must always be low, in order that connecting this instrument *in series* in a circuit will not affect same. Another important and interesting point comes in here in regard to both instruments, viz., the high electrical efficiency of the instruments themselves due to the very small amounts of electrical energy or power which they consume. Electrical power is proportional to $C \times E$. In both the voltmeter and ammeter the *product* of C and E is so small as to be practically negligible.

In most portable ammeters employed by the automobilist the shunt is placed in the instrument case. But in switchboard ammeters for charging storage batteries for electric vehicle propulsion or for ignition and lighting, and in many dashboard ammeters, it is customary to use a separate ammeter shunt and install same in the direct run of the main circuit, and to make use of a pair of small wires, no heavier and no more difficult to handle than the voltmeter leads, to connect from the terminals of the shunt to the indicating instrument.

The ammeter differs from its companion instrument, the voltmeter, in having no push button switch, and in one other noticeable detail of external appearance: the binding-posts. In the ammeter with internal shunt the binding-posts are naturally larger and heavier than in the voltmeter, to give a low-resistance connection for the far larger currents passing through the instrument. Ammeters with separate shunts, being in reality voltmeters as explained, of course require light binding-posts only.

The Dead-beat Instrument

In addition to reasonable durability, the value of the voltmeter and ammeter to the automobilist depends on the excellence of the design in attaining a uniform scale, precision, accurate reading, and "dead beat" quality—the last-mentioned permitting quick reading. A dead-beat indicating instrument is one in which the pointer, instead of whipping over the scale and then dancing back and forth before coming to rest at its indication moves quickly and smoothly up to the indication, going only very slightly beyond same before coming to rest.

Portable voltmeters and ammeters of the type described are employed in tests on the ignition and electric self-starting circuits of gasoline cars, on the electric lighting circuits of gasoline, steam and electric vehicles, and, in the higher ranges of instruments in tests on the propelling batteries of electric vehicles. For the last-mentioned type of car dashboard instruments are made, Figs. 9 and 10, continuously connected to the vehicle battery to enable the driver to watch the voltage of his battery and the current put into the same on charge and taken out on the road. A round-type switchboard instrument for mounting on the battery charging panels in the private or public garage is shown in Fig. 11. The dashboard ammeter is often furnished with a double scale, reading in opposite directions from the zero; the one pointer indicating the strength of current in charging and the other the motor load current. The dashboard voltmeter and ammeter are often furnished combined in one case, the instrument in this form being known as a voltammeter.

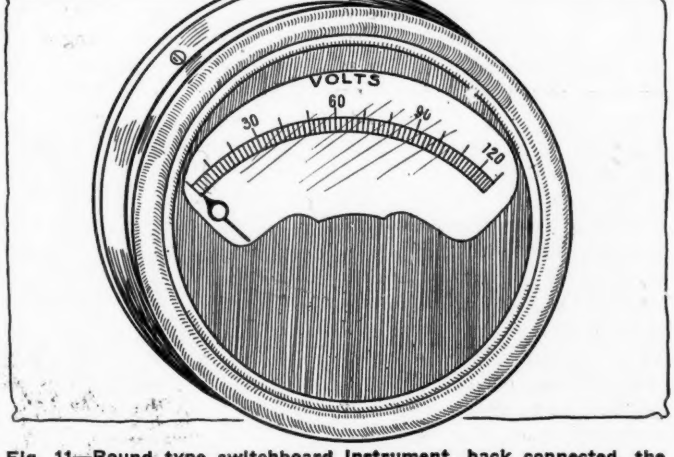
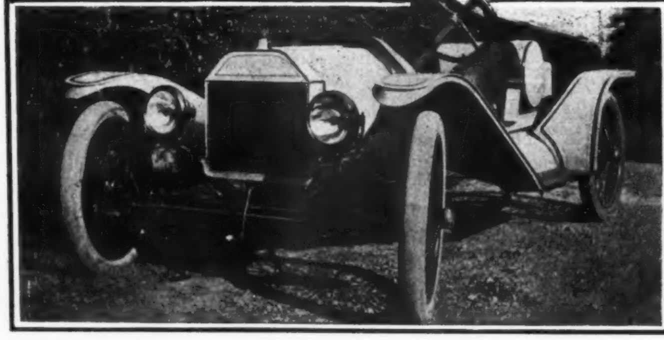


Fig. 11—Round type switchboard instrument, back connected, the terminal studs also acting as support



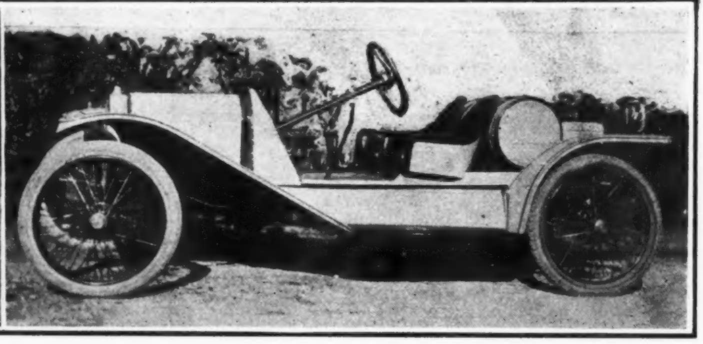


Fig. 4—Left—Front view of Ford racer, showing underslung springs Right—Side view of Ford, showing seating arrangements.

The Rostrum

Makes Chalmers and Thomas Racers

EDITOR THE AUTOMOBILE:—So much interest has been displayed lately in touring cars that have been remodeled into racing machines, that I believe that some of your readers will be interested in the machines I have built. These cars are shown in Figs. 1, 2 and 3. The latter machine is a six-cylinder, 1910 Thomas, while the other two are 1910, Chalmers 40 machines. The Chalmers cars were lowered by having the springs reset and fitting 34 by 4-inch wheels. The narrow radiator and hood on the machine shown in Fig. 2 was made according to my drawings, while the body of this car I built myself. On the other Chalmers machine I put a false front on the old radiator. The frame was lengthened 9 inches to bring the front axle out to the edge of the radiator. Special electric lights were fitted at the sides of the radiator and just over the frame, in place of the ordinary side lights. The front axle on this car was built up with a piece of wood to reduce the wind resistance. This piece of wood conforms to the shape of the axle and is sharpened to a fine edge. Wire wheels are a great aid to speed and are much better than wooden wheels, there being no wobble to the front wheels on rough roads.

The Thomas car was lowered by forging a new front axle and lengthening out the rear spring shackles. Lowering the car made it very much steadier at high speeds. An interesting feature in connection with this car is the method of carrying the spare shoes. An aluminum cover is clamped down over the shoes, holding them in place and preventing chafing. The cover only touches the demountable rims. The space inside the tires and under the cover is used for spare tubes and tools and is perfectly weather-proof. I use the Zenith carbureter on all my machines and find that it is extremely fast.

Providence, R. I. H. C. ORNDORFF.

Fig. 1—Chalmers 40, 1910 model, transformed into a racing runabout

Ford Racer with Underslung Springs

Editor THE AUTOMOBILE:—Seeing your design of the remodeled Ford on page 367 of THE AUTOMOBILE for February 5, I thought it might be of interest to know how we do the job in "Dixie." Fig. 4 shows the main features of this car. Notice how it has been lowered and the wheelbase slightly lengthened by removing the springs from on top of the axle and underslinging same. This little car is equipped with Bosch coil and high-tension magneto, and electric lights, current being furnished from the magneto in the flywheel. Oversize tires and a heavy set of wire wheels are used. It is just as speedy as it looks.

Birmingham, Ala. K. UNDERWOOD.

Questions on Remodeling E. M. F.

Editor THE AUTOMOBILE:—I am planning to change my E. M. F. into a racer and would like information on the following points:

1—What size holes would you recommend to be drilled in the pistons? How many per square inch? Would it not be better not to drill any over the wristpin, or, if any, none straight above wristpin?

2—Could only one or two rings be used on pistons designed for four rings?

3—Could I drill the top of the piston full of holes and then put on an aluminum plate of about 1-8 of an inch in thickness? This would lighten the piston and increase compression. How could I fasten the aluminum plate on? Can aluminum be brazed on?

4—Is successful two-plug ignition possible from an ordinary one plug magneto?

5—Would it be advantageous to run a fan, driven off the flywheel, in the intake line below the carbureter to insure that the cylinders get a full charge at high engine speeds? This fan would exert a pressure to the air passing through the carbureter.

6—What size of intake manifold would be the best for an E. M. F. racer?

7—How many revolutions per minute increase in motor speed is necessary with a 2.50 to 1 gear ratio to increase the speed of the car 1 mile an hour?

8—How many miles per hour is a car capable of whose motor speed is 2,800 revolutions per minute having a 2.50 to 1 gear ratio and 32 by 3.5-inch tires?

9—What can be done to obtain more speed from an E. M. F. Splitdorf magneto? How should it be set? Should breaker points be separated farther?

Should spark plug gaps be wider than on a touring car?

10—Could the speed of the motor be increased by feeding small quantities of any one of the following to the air in the intake manifold: Prest-O-Lite gas, sulphuric ether, oxygen? How much could a motor be increased in speed by the use of any of the above?

I should also like to add that it seems rather discouraging to any firm believer in the possibilities of poppet valve motors to witness the fact that no one dares to accept the challenge of the Moline-Knight manufacturers. What has happened to the gentleman from Connecticut who designed the Deltal? Why has the Deltal not been entered in recent races? It seems to me that there is now an unusual opportunity for some maker or designer of a poppet valve motor to gain world wide fame for both himself and his product by accepting some of these sleeve valve motor challenges which are so freely offered of late. Is it impossible for poppet valve motors to come up to these tests? Personally I think not.

Drill 1/4-Inch Holes in Pistons

—1—The amount of material that can be removed from a piston without unduly weakening it depends on the strength of the material and the severity of the service that the piston will be subjected to. The number and size of the holes that may be drilled in a piston is something that should be determined by experiment. However, it would be safe to drill 1-4-inch holes three-quarters of an inch apart. If you were to remove more material than this there would be danger of the piston breaking. It would not be advisable to drill any holes above the wristpin.

2—Two rings ought to be enough for high speed work.

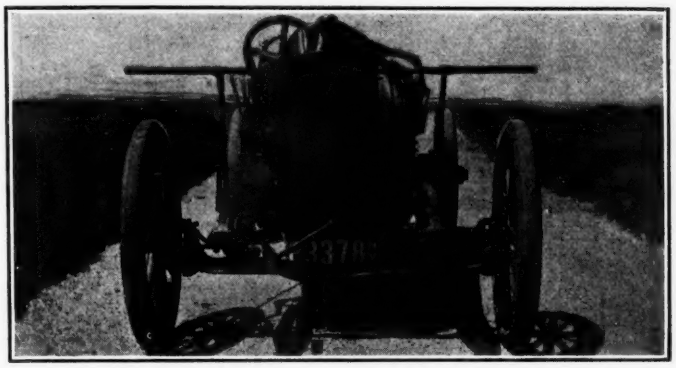
3—It would not be advisable to drill the top of the piston full of holes and then fit an aluminum plate as you suggest because the decrease in weight would be very small. Besides it would be difficult to fit a plate that would remain tight under the intense heat.

4—Two plug ignition from one magneto could be used but it would not give an appreciable increase in power on your car because it has an L-head motor. The main argument in favor of two-point ignition is that it reduces the time of combustion by setting fire to the charge in two places instead of in only one, but this argument only applies when the plugs are set on opposite sides of the cylinders as in a T-head motor.

5—Fitting a fan to the carbureter intake in order to increase the charge obtained by the cylinders is not practicable for the reason that it would be hard to obtain a fan that would handle the charge at the high air velocities obtained when the motor is running at its maximum speed. Either the fan would not be able to run fast enough to supply the required pressure or else it would be too bulky to be installed in the space available. This has never been used on racing machines.

6—It would be best to use the manifold you now have.

7—The change in motor speed for an increase in car speed of 1 mile per hour can not be determined without knowing the wheel diameters and the speed at which the car is traveling,



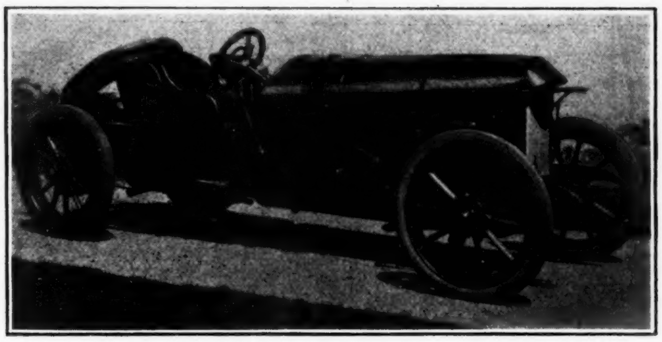


Fig. 2—Two views of a Chalmers 40 converted into a racer

therefore it will be assumed that 34-inch wheels are used and that the car speed is changed from 60 to 61 miles per hour. The relation between car and motor speed is expressed by the formula:

$$\text{r.p.m.} = \frac{\text{gear ratio} \times \text{car speed in miles per hour}}{\text{wheel diameter in inches}} \times 337$$

Substituting in this formula we find that the motor speed at 60 miles per hour is 1,487 while at 61 miles per hour it is 1,510 and the difference is 23 revolutions per minute.

8—The speed of this car is 106 miles per hour. This can be found by transposing the above formula as follows:

$$\text{m.p.h.} = \frac{\text{r.p.m.} \times \text{wheel diameter in inches}}{\text{gear ratio} \times 337}$$

9—Set the breaker points 1-64 inch apart and the plug points 1-32 inch apart. Time the magneto so that with the spark lever retarded the spark will occur 1-2 inch before the piston reaches upper dead center.

10—Prest-O-Lite, or sulphuric ether, will not increase the power of your motor very much, but oxygen will do so, according to the amount added. If pure oxygen were used the motor would develop five times as much power as with air, providing the carbureter was set to supply enough gasoline for a proper

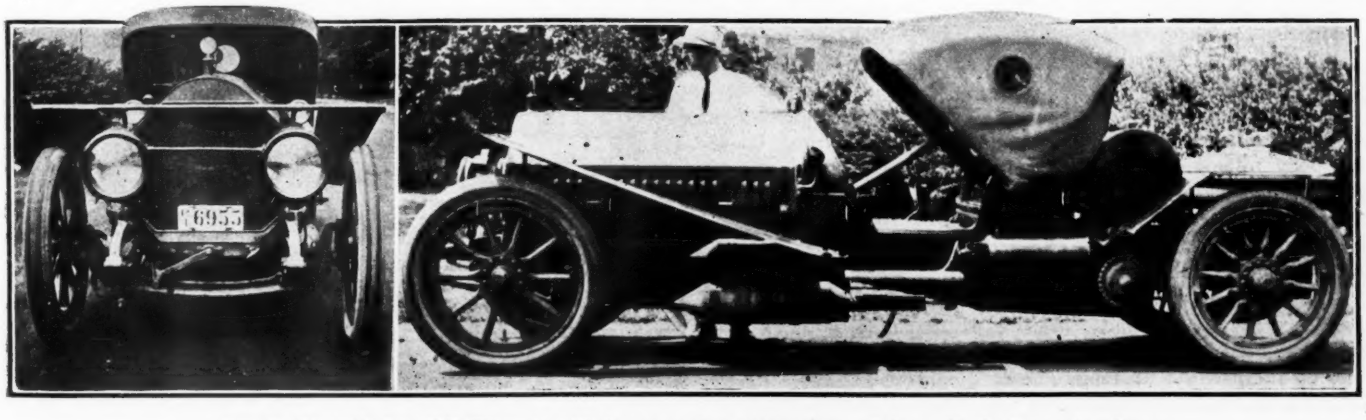


Fig. 3—Six-cylinder, 1910 Thomas with lower spring suspension. Note method of carrying tires

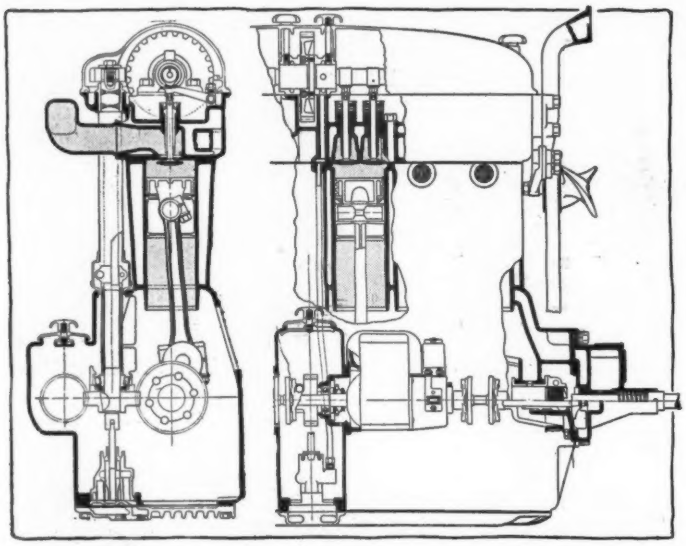


Fig. 5—Part sections through Premier Weideley motor, showing construction of detachable cylinder head

mixture under these conditions. Air is composed of approximately one-fifth oxygen and four-fifths nitrogen, but the latter does not influence combustion appreciably one way or the other. It merely occupies four-fifths of the space in the combustion chamber. Therefore, if pure oxygen were fed to the motor it is readily seen that five times as much gasoline could be burned as with air alone. The use of oxygen alone is not to be thought of however, first, because it is expensive, and second, because the motor would not be able to stand the great pressure developed. And even if the motor would stand this pressure it would not run long before it would begin to overheat.

The best way to use oxygen is to fit a tank on the car within easy reach of the driver and run a pipe from this tank to the intake manifold. The flow of oxygen can be regulated by hand and a dash adjustment on the needle valve of the carbureter will be needed to supply the extra gasoline.

After the motor is started, the oxygen is turned on gradually and at the same time the needle valve is opened. With the use of oxygen, there is great danger of the cylinders blowing up and therefore it is not advisable to increase the power of the motor any great amount by this means.

Only Stock Cars Should Be Raced

Editor THE AUTOMOBILE:—I have followed automobile races with considerable interest, and believe that it takes a cracking good car, one made of good material and well put together, to go into a 500-mile race and stand the grind of 70 to 80 miles per hour for 6 or 7 hours. The trouble is that the buying public does not get a car as well made as those entered in such races, although a large number of them are called "stock car races." The public has no confidence in the statement that stock cars are entered. It would be of benefit to the industry to obtain the confidence of the public in this matter, and to gain that confidence I propose a method of choosing stock entries as follows:

Let the automobile manufacturers send in their entries for the race, which is generally sanctioned by a governing body, this body to appoint a committee and this committee to have power to choose from the stock of any dealer a bona fide stock car to be the entry of the company represented by the dealer. Such a method would insure only stock cars, such as the public buys, being entered in races.

If it is more dangerous to race with a runabout body, the chassis should be stripped, but the regular bodied stock car should be used if possible. The driver should have ample time to tune up the car, but no replacements should be allowed. Races in which the cars were chosen in the above manner would represent the practical state of the art of automobile building and would be of considerable benefit to the buyer.

Bradford, Pa. A READER.

Description of Weideley Cylinder Head

Editor THE AUTOMOBILE:—1—Please inform me if a six-cylinder motor with seven ball bearings would be noisy?

2—Please give a drawing of the detachable cylinder head of the Weideley motor?

3—With an underslung frame and a worm drive would it be advisable to mount the worm under the axle?

4—Who manufactures the electric transmission, shown recently at the New York Show?

Tipton, Ind. E. G. D.

—1—A ball-bearing crankshaft is not noisy, except at high speeds, therefore a six-cylinder motor with seven ball bearings on the crankshaft should be sufficient at ordinary speeds.

2—The detachable cylinder head used on the Weideley motor of the Premier car is shown in Figs. 5 and 6. The cylinder head is a one piece casting in which all twelve valves are located in a row. These valves are directly operated by a camshaft that is fitted above them. Between the valve stems and the cams there are arms that are pivoted to the sides of the head and which take the thrust of the cams. The advantages claimed for this type of motor are that an exceptionally light and simple mechanism can be used, the combustion space is compact and the surface is reduced to a minimum and therefore the amount of heat lost to the waterjackets is very small.

3—Whether a worm drive should be mounted above or below the axle in connection with an underslung frame construction is a question that is not easily decided and unless the car is extremely low, straight line drive could better be obtained by mounting the worm above. When the worm is mounted below the axle, it is generally done for the reason that better lubrication of the worm is obtained as this part operates in a bath of grease. Mounting the worm in this position is open to the objection that it reduces the clearance under the axle, and for this reason a great many makers place the worm above, claiming that the lubrication afforded by the rotation of the worm gear, which takes grease from the bottom of the case, is sufficient.

4—The R. M. Owen Co., New York City, was the exhibitor of the electric transmission you mention. This transmission is known as the Entz system and was installed on an Austrian-Daimler car. The R. M. Owen Co. has acquired the American patent rights for this system and is planning to market a car.

Explanation of Double-Acting Motor

Editor THE AUTOMOBILE:—Kindly let me know if there is a motor with explosions on both sides of the pistons?

Springfield, N. J. CHAS. PINKAVA.

A motor that has explosion chambers on both sides of the pistons is commonly known as a double-acting motor, but there

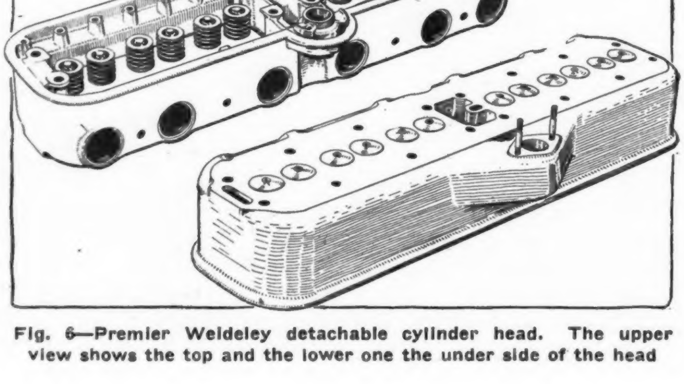


Fig. 6—Premier Weideley detachable cylinder head. The upper view shows the top and the lower one the under side of the head

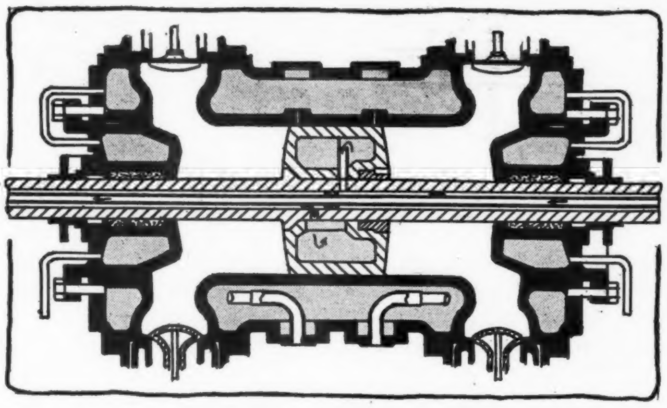


Fig. 7—Double acting piston used on large gas engines. The piston and stuffing boxes are water cooled

is no concern building such a motor for automobiles. While a double-acting motor would give twice the power of the ordinary single-acting type and yet not weigh very much more, there are a great many practical difficulties in the way of constructing an automobile motor of this type, although double-acting motors are the rule in large gas engine practice.

When a piston is subjected to the intense heat that is caused by combustion on both sides of it, some means is required for cooling it and this involves complications that are not warranted by the advantages gained by its use. Besides this, there is difficulty in keeping the packing around the stuffing box of the piston rod tight, and then there is danger of the rod heating up at this point.

In order to show the difficulties caused by such a design and in order to demonstrate the impossibility of adapting this design to a small motor, a large double acting gas engine is illustrated in Fig. 7. It will be noted that the piston is cooled by making the piston rod hollow and delivering the water to the piston through it. The water flows through the inner tube of the piston rod, then through the piston and out through the outer tube. The direction of the water flow is indicated by the arrows. In this engine the stuffing boxes are cooled by large water jacket spaces.

Another objection to this type of motor is that it would be a great deal higher than the ordinary single-acting design and a cross-head would be necessary in addition to other complications.

Suggests Horizontal Placing of Friction Wheel

Editor The Automobile:—In The Automobile for February 26, page 513, "Friction Transmission for Large Cars," what I would like to see answered is, why not operate the wheel and disk on a horizontal plane, then the limit of size would be the width of the car? I have examined one of these cars and personally see no reason why it cannot be done.

New York City. W. A. De Long, Jr.

There are two good reasons why your suggestion cannot be adopted. In the first place if the driven wheel were put in a horizontal plane its shaft would be vertical and in order to transmit the power from this shaft to the rear wheels, a set of bevel gears, in addition to the chain ordinarily used, would be required, as this shaft is at right angles to the rear axle. Your suggestion only applies to the driven wheel; the driving disk would be limited in size the same as with the conventional construction. It has been found desirable in practice to make these wheels about the same size for best results, but this would not be possible if your idea were adopted.

Horsepower Curves of 1914 Packards

Editor The Automobile:—1—Will you kindly publish in your columns the weights of the 1910 Packard 30 and 1914 Packard 38?

2—Will you please print the horsepower curve of the 1914 Packard 38 and 48?

3—Are most cars built with left hand drive and control, or left drive and center control?

4—What effect would there be if the gasoline feed pipe were wrapped around the exhaust pipe? Would not the gasoline become hot in the pipe and cause the gasoline tank to smoke?

5—What horsepower does the Pierce-Arrow 38 develop at 1,750 revolutions per minute and what is the weight of this car?

Washington, D. C. G. E. Stringfellow.

1—The weight of the 1910 Packard 30 is 3,700 pounds, while the 1914 38 weighs 4,070 pounds.

2—The horsepower curves of the 38 and 48 are shown in Fig. 8. A horsepower curve of the 1910 30 is unobtainable.

3—Left hand drive and control is used on 1.5 per cent. of the 1914 cars, while left drive with center control is found on 65.6 per cent. Right drive with center control is used on 11.8 per cent. and right drive with right control on 22.2 per cent.

4—If the gasoline feed pipe were wrapped around the exhaust the effect would be to vaporize the gasoline in the pipe and this would interfere with the gasoline flow. There would be nothing to cause the tank to smoke.

5—The Pierce-Arrow 1914 38 develops between 56 and 60 horsepower at 1,750 revolutions per minute. while the weight of this car complete with five-passenger body, cape top, glass front, gasoline and water, is 4,224 pounds.

Rich Mixture Makes Motor Miss

Editor The Automobile:—I have a 1910 40 horsepower Overland with Model L Schebler carbureter. This machine runs good but is inclined to be a little unsteady when throttled at very low speed and every time I stop it by turning off the switch, many times as much as half a teacup of gasoline flows back into the pan. Is there not some way of remedying this difficulty?

2—I note an item in your February 19 issue on valve spring testing. Would this rule apply to mechanically operated valves provided the springs were stiff enough that they could not be drawn open by suction?

Wauregan, Conn. F. B. M.

1—The unsteadiness of your motor is due to too rich a mixture, and this also explains why gasoline runs out of the manifold when the motor is stopped. Loosen up on the air valve until the motor runs smoothly. At the same time it might be a good idea to see that the needle valve is properly adjusted. Speed the motor up to somewhere near its maximum speed and then cut down on the supply of gasoline by closing the needle valve until the motor backfires. When this point is reached open up the needle valve slightly in order to stop the backfiring.

2—The valve spring testing machine described in the February 19 issue of The Automobile was designed especially for testing springs for mechanically operated valves.

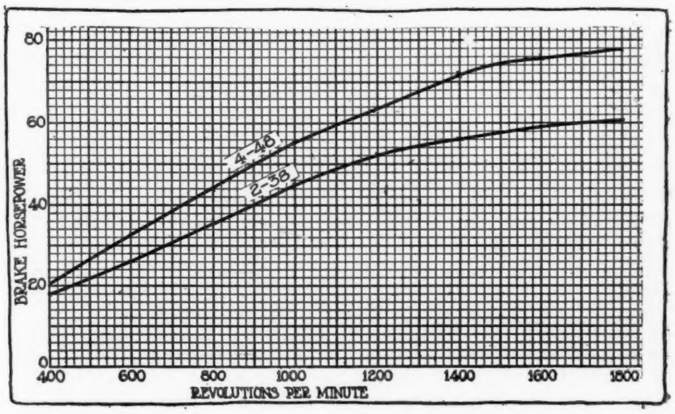


Fig. 8—Brake horsepower speed curves of 1914 Packard 38 and 48

The Engineering Digest

Why Pistons of Aluminum Are Wanted—How They Can Be Made to Work and Endure Stresses Properly

A REFINEMENT ADAPTED TO MODERN PRODUCTION

MANY automobile manufacturers now equip stock motors with aluminum pistons. Questions relating to this feature are therefore full of actuality. The reduction of the weight of reciprocating parts has in the past been looked upon as having reference mainly to the balancing of a motor, the obviating of vibrations, but with motor speeds exceeding 1,200 revolutions per minute, say, the influence upon power, fuel efficiency and wear becomes more important, especially as the balancing problems have been fairly well worked out through the attention which they have received and as the sharp competition among manufacturers renders it necessary for each to get as much power out of given cylinder dimensions and piston speeds as his rival gets.

As the forces of inertia are proportional to the mass of the piston and connecting-rod, any increase of this mass adds to the friction to be overcome at the bearings of these parts. With modern lubrication, which minimizes friction in the rotary bearings, it is especially the lateral friction of the piston against the cylinder wall which counts. Two methods are available for reducing this friction. The lubrication of the piston may be improved, which is a difficult matter, and the forces of inertia may be reduced through a considerable reduction of the weight of the piston. The latter method brings a double gain, the forces of inertia acting longitudinally being at the same time reduced, which has the effect of increasing the piston speed and improving the thermal efficiency. To materialize this double gain, either the existing cast-iron piston may be turned down to a minimum weight, which involves a costly machining process, or aluminum pistons may be adopted.

Other factors equal, such as those relating to valve sizes and valve timing which are now universally understood and considered in the design of motors of high degree, it may be said that the relative power efficiency of two motors is now proportional to the weights of the alternating parts.

Pistons Before Connecting-Rods

As a lighter connecting-rod can be used with a lighter piston, while the obverse is not true until means for creating a light piston have been worked out in practice, it is clear that the question of the weight-reduction with regard to the piston comes foremost. [It is perhaps not evident, however, that a sensibly lighter connecting-rod can be used with a lighter piston. Even in the case of motors of such high speed—about 3,000 revolutions per minute or a piston speed of 42 feet per second, with a 5 inch stroke—that the forces of inertia exceed those caused directly by the explosion, the question must be considered with reference to the direction of the stresses, tensile in one case and compressive in the other, and especially with reference to rigidity against bending moments arising form lateral pressures. These well-known considerations, while they result in viewing the weight and design of connecting-rods quite separately from piston design, do not, on the other hand, affect the author's contention that it is the question of the weight of the piston which at present comes foremost in actuality, since it is one which in general manufacturing practice has received no satisfactory solution, so far.—ED.]

General interest in aluminum pistons is further enhanced through the fact that they are little more expensive than ordinary cast-iron pistons and cheaper than pistons turned down from drop forgings.

The use of aluminum for pistons calls for a metal of uniform texture and wholly free from blowholes, while it may have the slight surface pin prick dents nearly always found on cast aluminum. A special alloy has been developed for this use by the Corbin firm whose product is at present the only one employed in stock cars with this equipment, and many experiments were necessary before a satisfactory shop practice with regard to the crucibles, the molds and the pouring had been evolved. Other difficulties naturally arose from the fact that the expansion by heat of aluminum is nearly twice as large as that of cast iron. The proportions among the coefficients are given in the following figures: Cast iron 111, steel 115, Corbin alloy 210 and pure aluminum 220. At high temperatures the difference in the coefficients becomes only slightly less pronounced. The natural inference was that it would be necessary to provide nearly twice as much play between the cylinder wall and a piston made of aluminum as between a cylinder and a piston both made of cast iron. The situation was in reality found to be quite different. There was a disquieting rattling when the play was twice as large as with cast-iron pistons. On the other hand, if it was made no larger than with cast-iron pistons, friction was excessive, though actual seizing did not follow. When it was attempted to determine the exact play by shaving off a very thin film of metal after each trial, until the motor ceased to run hard, it was found that the moment the hardness was overcome the rattling began. Similar difficulties have deterred other investigators on this road, but it has now been found practicable to overcome them.

Aluminum Easily Cooled

The property of aluminum which pointed the way out of the trouble was its conductivity for heat. While its coefficient of expansion is twice that for cast iron, its conductivity is 2 1-2 times greater; that is, a given section of aluminum transmits a 2 1-2 times greater amount of heat in a given time. Consequently, the heat which travels from the head of an aluminum piston to its cooler cylindrical portion is at least twice as great, between two explosions, as that which travels through a cast-iron piston, and the cooling water therefore gets a better chance

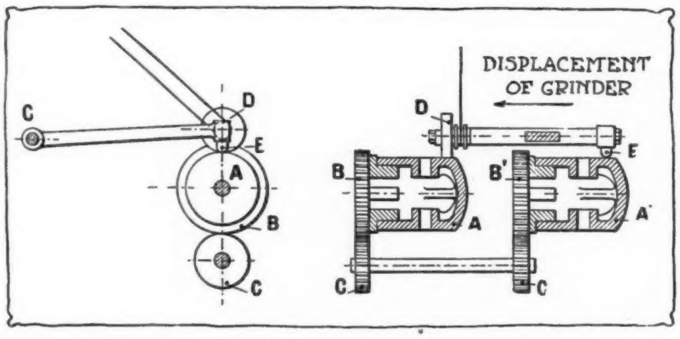


Fig. 1—Diagram of machine arrangement for reproducing peculiarities of one aluminum piston upon another

at removing this heat and keeping the piston cool. A slightly contrary effect comes into play through the fact that aluminum gives up its heat, at the transmission from the piston to the cylinder wall, a little less readily than cast iron. These complications render it difficult to find an exact value for the play which should be allowed on the basis of regular expansions and the known coefficients alone. The solution was found in practice by taking into consideration, in an unusually thorough manner, those irregularities in the expansion which occur in all motor cylinders but which are only roughly taken into account where cast-iron pistons are concerned.

A more detailed explanation at this point may be necessary: Though a motor cylinder may be bored and finished to perfect interior circularity, it does not remain round when heated. An irregular deformation is inevitable and would be so even if the cooling water were of an absolutely evenly distributed temperature, which in practice is far from being the case. Inequalities in the thickness of cylinder walls occur frequently, especially with four-cylinder blocks in which the intervals between the axes of cylinders are completely determined by design while the outside formation is subject to minor changes, either by warping of the pattern or by unavoidable small displacements of the mold or its cores. Moreover, valve boxes and their pipe attachments, as well as sand gates and plugs, cause more or less one-sided accumulations of metal which in turn cause deformations when the cylinders are heated. Neither does the piston remain round. It, too, has variations in thickness; ribs and bosses, hubs for the piston pin.

Prismatic Piston Surface

It is therefore needful to find a method of machining which takes these deformations into account. The use of aluminum, with its large coefficient of expansion makes this doubly necessary. That the method devised in this respect by the Corbin firm is effective is proved by the fact that more than 800 vehicles have been in operation for one year, and in some instances longer, each with a set of four aluminum pistons, without the least trouble arising.

The method is based on the idea that the deformations which will occur in cylinders 1, 2, 3 and 4 and in the pistons for each of them, in one instance, will occur again in corresponding cylinders and pistons of other motors made in the same series of manufacture. To keep track of the deformations, after having ascertained them, is therefore the first requirement. To this end, there are mounted in a motor, of the model to be supplied, four pistons which have been accurately ground to a fit which would be correct for cast-iron pistons. This fit will prove too tight. The motor is started and operated at low speed until it gets hot and is then run at higher speed for some minutes. It is then dismounted and the pistons are numbered according to the cylinders in which they were used, 1, 2, 3 and 4. Each of the pistons will show certain marks of hard wear, in the form of shining streaks. A skilled workman removes with a soft file these shining portions which indicate an excess of metal. Thereafter the pistons are again mounted in their respective cylinders, and a second test is made with the motor running a little faster and a little longer than before. After again dismounting, what excess metal is shown is again removed, and this process is continued until the pistons move as freely at high speed and with the motor hot as when cold. Of course the aluminum cannot be prevented from expanding twice as much as cast-iron, but so far as the motor is concerned for which the pistons are being adjusted a set of pistons is obtained which has the smallest possible amount of play, so that they do not strike or rattle when the motor is started and remain free when the motor is hot. Nothing detrimental to the cylinders happens if such pistons are allowed to become overheated to the point of seizing, as the special nature of the alloy obviates all intimate union of it with the cast iron of the cylinder. A gripping of one against the other results only in the detrition of

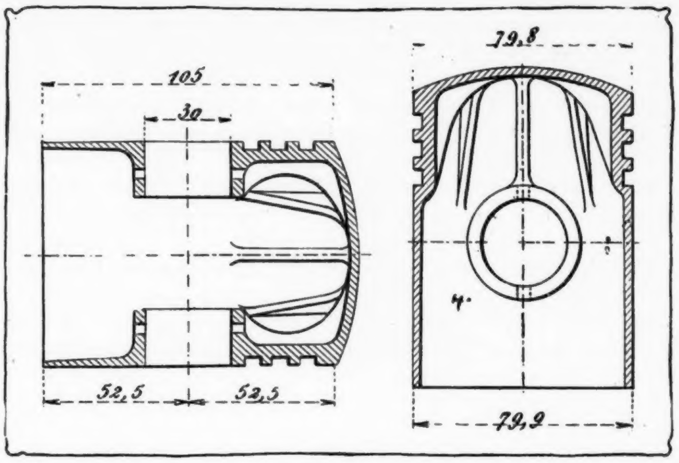


Fig. 2—Dimensions and formation of piston made of aluminum alloy for cylinder bore of 80 millimeters

some aluminum, which is softer than the cast iron, but the cylinder loses none of its polish and receives not the slightest scratch.

If it were necessary to go through the whole process of piston-shaving for each motor, the cost would be prohibitive by reason of the time used in mounting and dismounting. What is actually done is to reproduce mechanically each piston of the first set in such manner that all pistons of the same number in the different sets become alike. The first thing done for this purpose is to machine all pistons just as a cast-iron piston would be machined and then to divide them into lots 1, 2, 3 and 4. Subsequently the pistons of each lot are corrected on a machine arranged on the plan shown diagrammatically in Fig. 1, so that all of lot 1 become No. 1 pistons, all of lot 2 No. 2 pistons, etc. The machine, in other words, is a machine for reproducing the little peculiarities of each of the pistons of the first set, the original Nos. 1, 2, 3 and 4. The original is placed on a mandrel B′ and the piston to be shaped in its likeness is chucked in exactly similar manner upon mandrel B, these mandrels or stocks being driven alike by means of gearing and the shaft CC′. A longitudinal feed as well as rotation is provided, as in a lathe. The contact E of the reproducing-tool follows the inequalities in the surface of the model piston, whose movement is very slow, and thereby raises and lowers the shaft DE upon which it is mounted, and which in turn is pivoted by links to a parallel shaft G.

Every movement of the contact is thus exactly reproduced at the other end of shaft DE, where the grinder D is mounted to be rotated very rapidly. As D and E at all times come in contact at exactly corresponding spots of the two pistons and every depression in the model piston puts grinder D to work to remove metal from the other piston, it is evident that the action will result in the two pistons becoming alike in all their irregularities, if only the movements are sufficiently slow to permit the grinder to finish its work in each spot.

The lateral movement of the grinder, or of the work, can of course be repeated as often as may be necessary for accuracy.

While this process of special shaping naturally adds slightly to the cost of the manufacture of pistons, it represents at present the only manner in which pistons of minimum weight can be made to function satisfactorily.

Precautions in Design

Certain special precautions are to be observed in the design of the aluminum pistons. Fig. 2 shows the dimensions and ribs used for a piston of 80 millimeters diameter. The very large size of the hubs for the hollow piston pin will be noticed. It is necessary in order to offset any tendency to plastic deformation of the hubs, to which aluminum would be more liable than cast iron.

In choosing the means for holding the piston pin in its place, all screwthreads in the aluminum should be avoided, as they are not very reliable. It is sufficient to use a large split pin for which a transverse bore in the hub is provided. If this pin is of steel and is fitted closely, it should not be required to have one on each side, though two are indicated by the two transverse bores shown in the drawing. Each bore calling for a separate mounting and machine operation, the extra cost involved in using two is worth avoiding.

The piston head must be stiffened by a number of thin but rather strongly marked ribs, as aluminum begins to soften at a considerably lower temperature than cast iron. These ribs also facilitate the cooling of the piston. In the matter of strength, if it is desired to resort to calculations, the same coefficients can be used as for cast iron, allowing 1.5 kilograms pressure per square millimeter. The grooves for the piston rings can have exactly the same dimensions as for ordinary pistons. The thickness of the head after machining should be at least 4 millimeters for small pistons and need not be more than 5 millimeters for large ones provided they are well ribbed. The castings should not be made thinner than 4 millimeters in any place, but this can be shaved down to 1.5 or 2 millimeters for the lower portions of the piston cylinder. A certain guarantee of sound castings is obtained in this manner, and the cost of the machining is not more, perhaps, than the value of the shavings.

Mechanical Advantages

The friction of aluminum against cast iron is smaller than that of cast iron against cast iron, and this factor, which enhances the mechanical efficiency of a motor, coupled with the freedom from liability to seize which is characteristic of aluminum pistons, constitutes advantages which, it is believed, will assure these pistons a permanent place in the motor industry.

The weight, when the piston is made as explained and from the Corbin alloy, is less than one-half of that of a cast-iron piston of the same strength.—From *La Technique Automobile et Aérienne*, February 15.

Standardization of Insulating Materials Begun in Germany

NO other requirement is so important with regard to the installation of electric devices of any kind as their dependability. If they are not entirely reliable and mechanical devices can take their place, the preference will be given to the latter. The demands made upon insulating materials—which have more to do with reliability than any other one factor—are therefore becoming more and more severe in the industrial world, and with the increasing use of the electric current in automobiles—especially if it is to be used not only for ignition and lighting, but also for actuating gear changes, for motor-starting, for brakes and for power transmission in general—these demands bid fair to become reflected in the automobile industry the moment the problems relating to the installation of electric devices in a car come to the surface, after those relating to design and scope of functions have been solved. It stands to reason that loose wires will be avoided as much as possible and that some regard for economy in the choice of materials will prevail. The preliminary work which has now been undertaken by a committee of the Society of German Electrotechnicians in conjunction with the renowned Royal Materialprüfungsamt (Institution for the Testing of Materials) at Berlin-Lichterfelde and the Physikalisch-Technische Reichsanstalt (Technological State Institute) at Charlottenburg, with a view to determining the properties in all important respects of the very numerous insulating materials which are flooding the market, must therefore eventually prove of direct benefit and may even at this moment be of considerable interest to automobile builders.

Mistakes have been made in the past in according a too-predominating importance to the electrical properties of these materials and neglecting the mechanical and chemical properties by which the durability and therefore also the reliability of an installation are more decisively determined in most cases where no high voltages are involved.

When the work was begun in the fall of 1913 it was decided, in order to arrive at practical results as soon as possible and keep interest in the experiments alive, to limit the tests of the first series to 16 representative artificial insulating materials and to elaborate directions for their use only with reference to voltages not exceeding 500. It was also decided to reduce the great variety of tests eventually to be made to a much smaller number to begin with, dealing most directly with the most important properties. Following these lines, the committee first took up the following properties for examination:

(1) Rigidity, or strength against a steadily applied bending pressure, (2) rigidity against shock, (3) hardness by Brinell ball test, (4) resistance to heat, (5) resistance to frost, (6) resistance and behavior under exposure to flame. The electrical properties singled out as most important were the surface resistance and the security against arc formation.

Directions with regard to the tests used for ascertaining these fundamental properties have already been formulated, and a large number of other tests have been completed with the 16 selected materials. They relate to such properties as the suitability of a material for holding bolts and screws, its consistence at different temperatures, the influence of humidity and steam, the effect upon it of inclosed metallic conductors, the important hygroscopic properties (which militate against fiber, for example), effects of acids and alkalis, various oils, seawater, alcohol and ozonized air.

For the classification of the materials a point system has been adopted. At any tests of which the results can be indicated numerically each material receives its place in one out of six classes, from 0 to 5, in accordance with a corresponding division of the possible test figures, and it is intended to enlarge the number of classes if materials are produced in the future ranking above those now known.—From *Kunststoffe*, February 1.

Sweden Moves To Produce Motor Oils from Alumshale

SWEDEN will, if possible, make its own motor fuels, the importation of which now costs the country nearly 5 million dollars. Parliament last year petitioned the government to undertake the experimental work and a syndicate of manufacturers placed a patented process for deriving the oils from alumshale at disposal and has promised to bear one-half of the expense in ascertaining whether the enterprise can be made practicable. The shale is found in large quantity in Vestergötland, where the deposits equal in heat value one-half of that of all the peat bogs in Sweden, and also in Oeland, Sconia, Oestergötland, Nerike and Jemteland. The by-products would be sulphur and sulfate of ammonium, which are both substances now imported.

Anent the Status of Synthetic Rubber

From the first report of the Synthetic Products Company of London, which was formed a little more than one year ago to manufacture artificial rubber, it appears that the machinery for entering upon actual manufacture has been finished and delivered only very recently and that therefore no proof can be furnished as yet as regards the rentability of the enterprise. The administration promises, however, to furnish this proof in a few months and maintains that the artificial rubber will be much cheaper than the natural. The cash resources of the company have meanwhile been reduced to a balance of about $65,000, and *Frankfurter Zeitung*, in commenting upon the report, doubts whether this will be sufficient to take the concern out of the experimental stage.

Boring and Reaming a Gearcase in 8 Minutes

Special Machine Constructed in the Jeffery Shops Cuts Cost of These Operations 75 Per Cent. —Some Ideas of Factory Layout

THE machine shown in the accompanying illustration is used in the factory of the Jeffery Co., Kenosha, Wis., and bores and reams a Jeffery transmission case in 8 minutes. Working at this speed this new tool saves 22 minutes on each case, as the former tools used required a 30-minute period. One man handles the entire work of putting through the aluminum housing and in a 10-hour day he can finish seventy-five of them.

The work that has to be done on these machines consists of boring and reaming the three pairs of shaft bearings in the new unit transmission case. All six holes are bored and reamed at the same time, the boring tools at one end piloting into the boring tools at the other end of the case. This design of machine is meritorious in that the piloting arrangement guarantees accuracy in the alignment.

Engineers of the Jeffery company have estimated that the cost of finishing the transmission case has been cut about 75 per cent. by the use of this machine, and, in addition to this, it turns out a more satisfactory job, as far as finish and accuracy are concerned.

The new transmission machine is entirely a product of the Jeffery company, having been made in the company's plant. Improvements in the machinery used by the Jeffery firm have been necessitated by the increased output which, according to statements issued by the company, will double that of last year.

Factory Layout for Efficiency

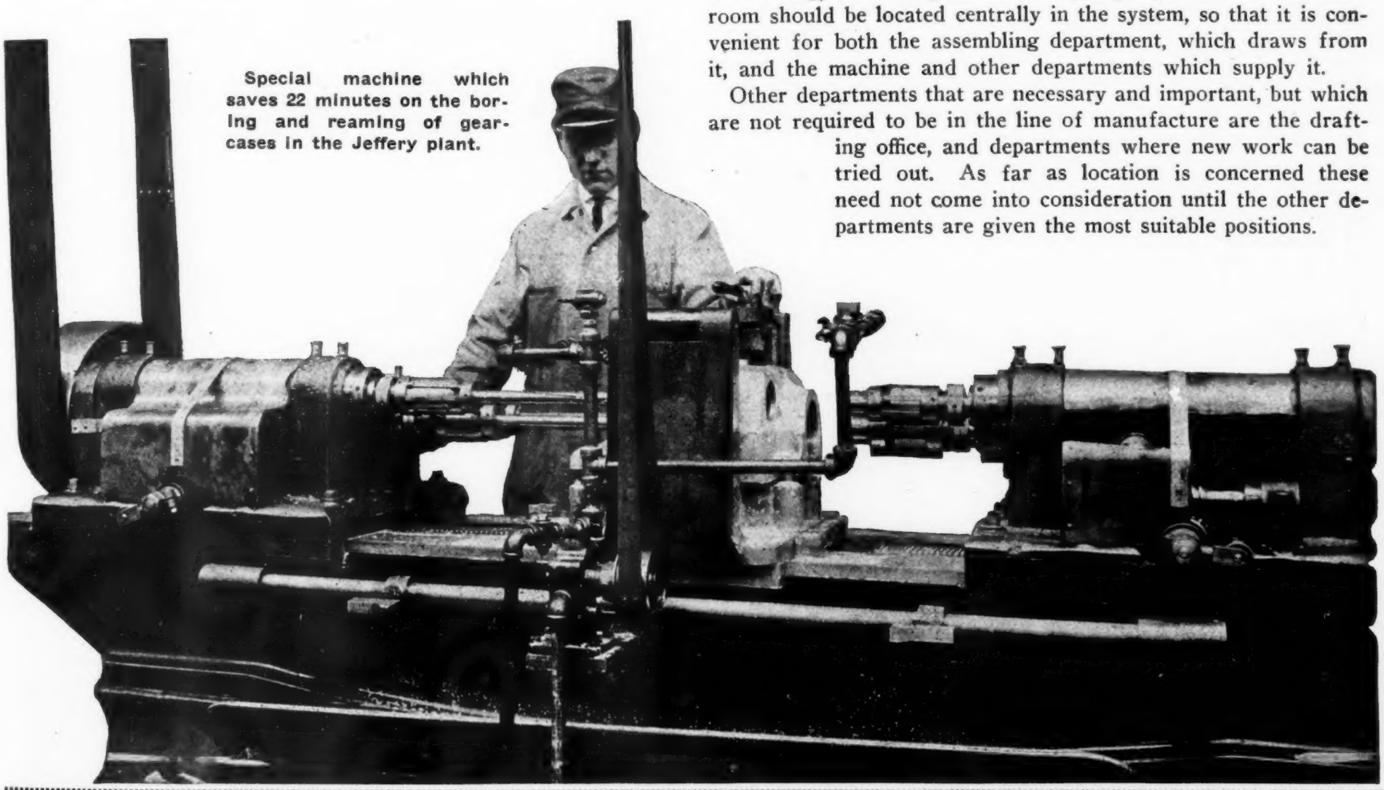
PRACTICALLY all modern factories which show particular excellence of systematic manufacture are those turning out an article that had previously been made by the same concern in a less efficient manner. In other words, though it is possible to design a factory in the first place to meet the manufacturing requirements of a new article, there are inevitable changes in the machining, assembling, or stocking processes that can only be discovered after actual work has been carried out. But once the sequence of operations has been decided on, the layout of the factory requires only careful thought.

Maximum Output to be Considered

The desired maximum output is the first consideration, and from this should be obtained an approximation of the required floor area. A fair amount of space should be added to this to provide for expansion, and the whole amount divided into departments, having regard to the number and size of the floors. The location of the machines that are first used should then be determined by reference to the sequence of manufacture, and also with regard to the elevator or means of transferring the parts to the next department. Machines which cut off raw stock, saws, punching presses, and similar heavy machinery should be located near the receiving department. Automatic lathes, drills, and milling machines should be arranged in banks in a definite order, so that during manufacture the parts can pass along the line from one to the next without loss of time.

Other departments that should be arranged with reference to this one and to the elevator, are light machine or bench work and testing, concluding with the shipping department. The stockroom should be located centrally in the system, so that it is convenient for both the assembling department, which draws from it, and the machine and other departments which supply it.

Other departments that are necessary and important, but which are not required to be in the line of manufacture are the drafting office, and departments where new work can be tried out. As far as location is concerned these need not come into consideration until the other departments are given the most suitable positions.



Special machine which saves 22 minutes on the boring and reaming of gearcases in the Jeffery plant.

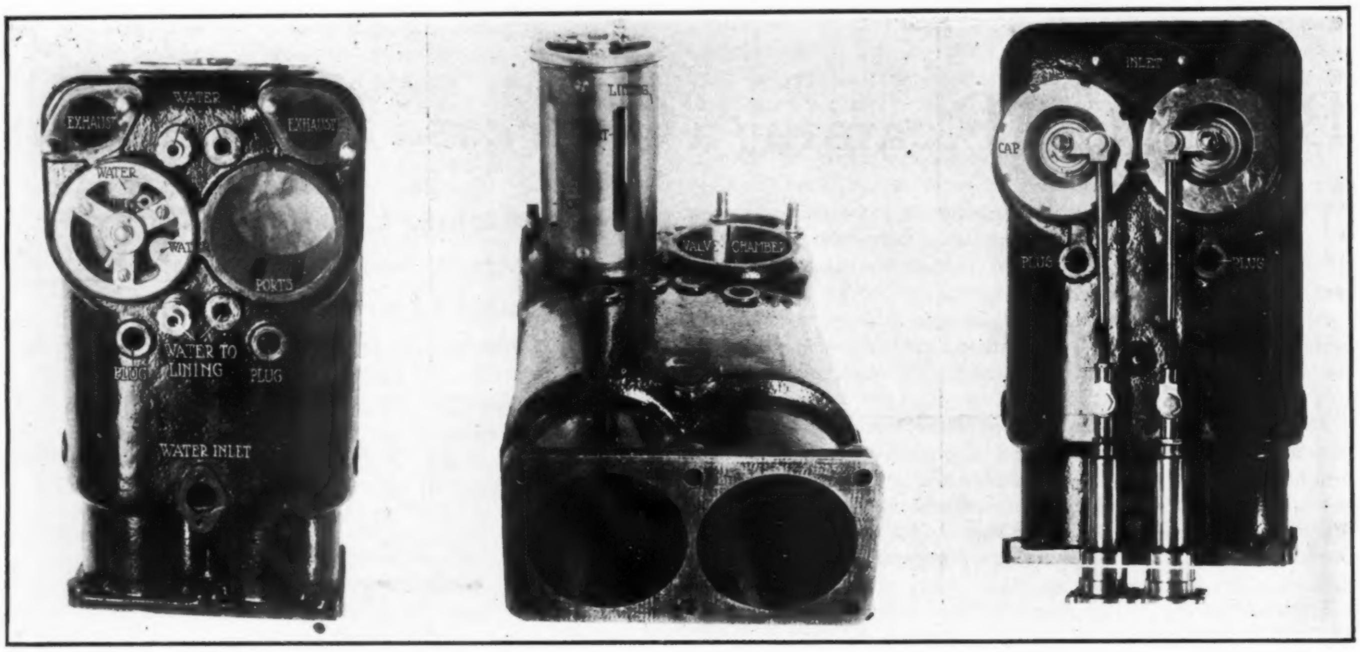


Fig. 1—Views of Taft engine in various degrees of assembly with valve and liner in and out of position

Develops Oscillating Slide Valve Motor

New Engine Constructed by Fred Belcher, Former Driver of Knox Racing Car

SPRINGFIELD, MASS., March 4—A new motor brought out in this city by W. E. Taft, a mechanical engineer whose name is connected with many successful patents, and Fred Belcher, who formerly drove the Knox racing cars, involves several new and interesting features which are worthy of careful note.

Mr. Taft has had considerable experience as a steam engineer, and the basic idea of his motor runs very much along steam engine lines, the action being markedly similar to that of the Corliss engine. An overhead oscillating slide valve, which is held to its cylindrically shaped seat by compression or explosion pressure, is the main point of departure from ordinary automobile engine practice. As the valve oscillates on its seat it uncovers the inlet and exhaust ports which are directly above the combustion space and absolutely free from curves or angles, thus giving a direct flow to the gases entering and leaving the cylinder. The valve is driven from a camshaft and tappet rod in the ordinary way except for the addition of a bellcrank lever to give the oscillating motion.

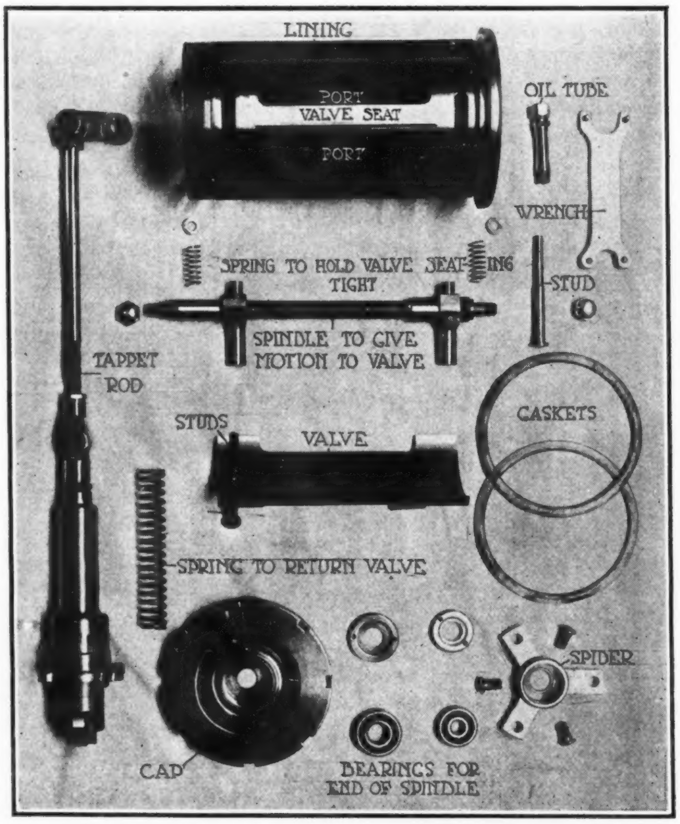


Fig. 2—Parts making up valve action of Taft motor

Has Straight Ports

The prominent points which stand out in relation to this motor are the straight valve ports and the absence of wearing parts. The motor upon which the experimental work has been done is a six-cylinder, 4.5 by 5.5 Beaver, which has been left untouched except for the installation of the new valve action and cams. On this motor the clear valve opening for both inlet and exhaust is in the form of a slot 4.25 inches long and .375 inches in width. The dimensions of the valve opening can be increased or decreased by altering the travel of the valve and the dimensions of the slots. The valve timing used does not vary to any large extent from standard practice in the poppet type; the following being used:

Inlet Opens—4 degrees past top center. Closes—38 degrees after bottom center.

Exhaust Opens—45 degrees before bottom center. Closes—2 degrees after top center.

Below the combustion chamber there is no difference between the Taft motor and the ordinary poppet valve type. The construction above the latter point, however, differs materially. Referring to Fig. 1 the valve action is shown in three degrees of assembly. As will be seen there is a cylindrical passage

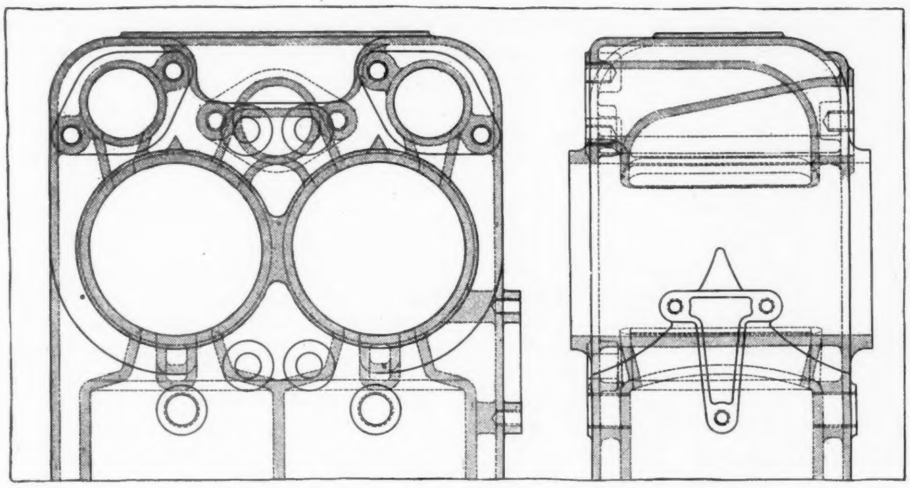


Fig. 3—Arrangement of waterjacketing spaces and coring

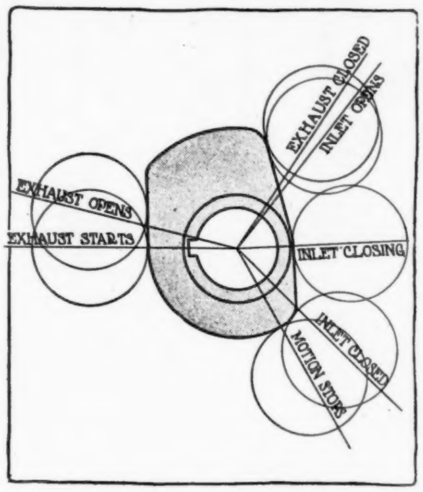


Fig. 4—Contour of compound cam

in the main cylinder casting directly above each compression space. This cylindrical passage communicates with the combustion space in the top of the cylinder by two slots which form respectively the inlet and exhaust ports. It may be noted in passing that these slots are surrounded by waterjackets.

Fitting into the cylindrical opening is a casting which is known as the inner liner. This casting fulfills several purposes. It acts as a seat for the valve, a carrier for the shaft which actuates the valve, includes the waterjacketing for this part of the action and includes also the lubricating system for the valve as it acts on its seat. The seat of the valve is that part of the lining between the two ports.

Through the center of the cylindrical liner runs the shaft or spindle which oscillates the valve. This shaft of steel is mounted on two Hess-Bright ball bearings. The shaft carries two steel studs which pass through slots in liner and through these the motion of the shaft is carried to the valve. On each of the studs is a spring which presses the valve against the seat when it is not acted upon by compression or explosion pressure. The motion is given to the shaft by exterior mechanism which may be seen in Fig. 1. As will be noted it corresponds exactly to a poppet action with the exception that, in order to secure the oscillating action, a bellcrank lever has been used at the end of the valve-actuating spindle. The entire assembly is shown in Fig. 5.

The water for cooling surrounds both ports through the liner and thereby affords an arrangement for allowing the valve to operate between two waterjackets. Lubrication is by pressure to the valve seat where a slot is provided for holding the oil.

At the time of explosion the valve covers both ports and the under side of the valve forms the top of the combustion chamber, thus receiving the pressure of the exploding gas and being held firmly on its seat by this pressure.

Compound Cam Used

The cam which operates the valve is compound, taking care of the motion of the valve mechanism both for the intake and exhaust, thus cutting in half the number of push rods and tappets. The valve mechanism is held to the cam by a spring which is inclosed in the push rod guide casing. A view of the cam showing how the timing is laid out and the length of time each of the ports is kept open is given in Fig. 4.

The fact that at the time of the explosion the under side of the curved valve is submitted to the hot gas in the cylinder leads to the question of the possibility of its warping, due to this influence. According to Mr. Belcher, the engine was submitted to an extended run of several hours under load and at the end of this time a straw color was the highest noted. The motor is at present assembled in the chassis shown in Fig. 5, but has not as yet been tried out on the roads or on the blocks. It is expected that a horsepower test will be given it at the laboratory of the Worcester Polytechnic Institute as soon as extensive road tests have been made. It will be surprising if a car equipped with this motor is not found entered in contest work during the coming summer with Fred Belcher at the wheel.

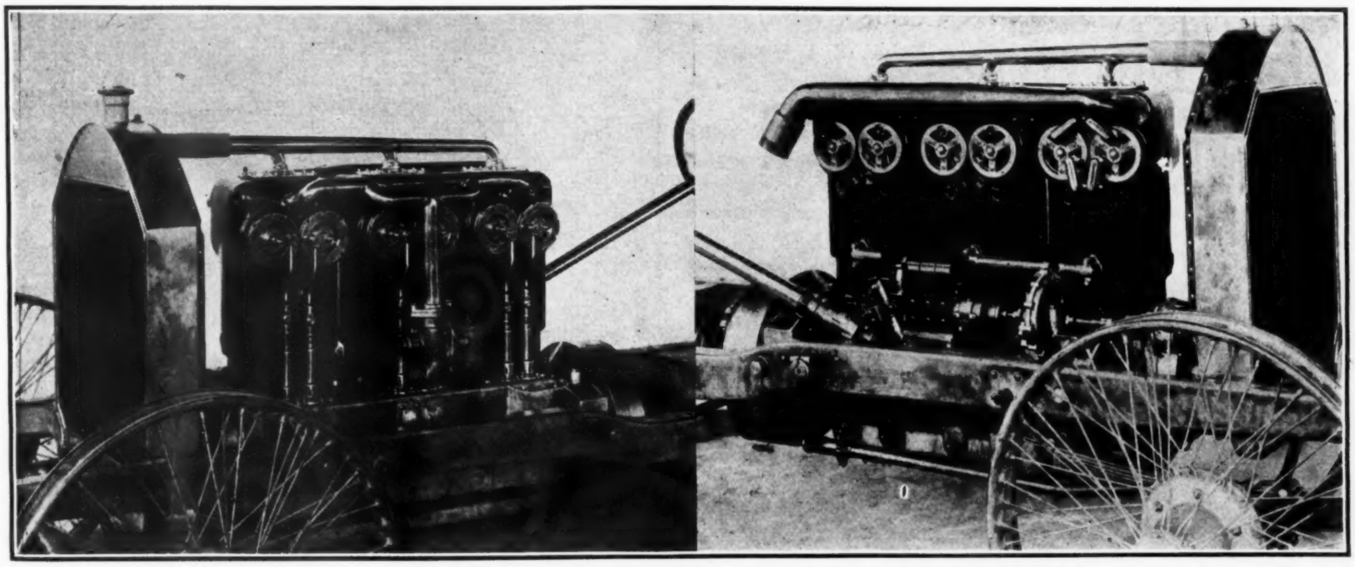


Fig. 5—Views of both sides of new engine as assembled in trial chassis to be tried on road

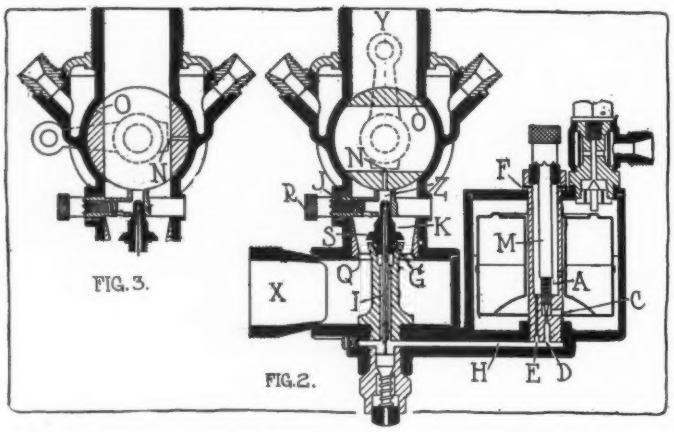


Fig. 2—Vertical section through Longuemare carbureter showing throttle closed. Fig. 3—Section through spray chamber, with throttle open

Longuemare Carbureter Shows Economy in Test

Attached to White Motor It Shows Highest Efficiency at 1200 r.p.m., Consuming .61 Pound per Brake Horsepower

AN official test of a 1¼-inch Model F. B. 34 Longuemare carbureter was recently conducted by Joseph Tracy at his laboratory, East Rutherford, N. J., under the official direction of the Manhattan Automobile Club, which has effected arrangements whereby its tests are made in this laboratory. The test lasted over a 6-hour period, in which the motor was run at different speeds from 300 revolutions per minute to 1,600, with different intervals of time for each. The carbureter was attached to a four-cylinder White motor, 3.75 by 5.125 inches bore and stroke, which was coupled to the Sprague electric dynamometer of the laboratory.

The test showed 6.60 horsepower at 330 revolutions per minute and a gradual rise until at 1,600 the horsepower measured 33.38. As Fig. 1, the horsepower curve for the test, shows the curve to be practically a straight line to 1,400 revolutions per minute, where it begins to flatten slightly; at 1,500 the flattening is more pronounced, and at 1,600 the curve becomes nearly a straight line. As adjustments to the carbureter were not permitted and the throttle kept wide open all of the time, the curve is a very satisfactory one.

While the horsepower readings were taken fuel consumption was also measured at 15-minute intervals. At 330 revolutions per minute the curve shows the fuel consumption to be .72 pound per horsepower hour. With the speed raised to 405 revolutions per minute the fuel economy increases. In other words, the consumption falls to .66 pound per horsepower hour. At 800 the consumption fell to .63 pounds. It remained here at 1,000, and at 1,200 revolutions per minute reached the lowest mark in the test, namely, .61 pound per horsepower hour. From 1,200 revolutions per minute up the fuel consumption increased. At 1,400 it had risen to .62 pound per horsepower hour and at 1,600 it was up to .66.

These figures show that the fuel economy is slightly lower at low speeds as well as at those above 1,200, the carbureter of course being set to give its horsepower at 330 revolutions per minute. Had the test started at 400 revolutions per minute the Longuemare company, New York, for whom the test was conducted, claimed that a better fuel consumption curve would have been obtained. An economy of .61 pound per horsepower hour at 1,200 revolutions per minute shows a good practical fuel consumption, as this is the speed at which motors of this type operate a large percentage of the time.

The object of the entire test was to show in a practical manner and through a practical range of motor speeds the brake horsepower at various speeds without adjustments, as well as the fuel consumption. During the test the carbureter was heated by water through the jacket, and previous to the test it was adjusted by a representative of the Longuemare company. No muffler was used on the motor, the exhaust passing to the atmosphere through a length of iron piping 2½ inches in internal diameter. Ignition current was supplied by a Mea magneto to Bosch spark plugs. While the test was on readings were taken every 5 minutes. These readings were averaged for 15-minute intervals throughout the entire range. The ignition was timed to give maximum torque at the various engine speeds.

The following figures show the test results for 15-minute intervals:

R. P. M.	Brake Load	Fuel in Lbs.	Water In	Water Out	H.P.	Lbs. Per H.P. Hour
300	27.5	1.18	143	182	6.60	.72
405	29	1.49	145	177	8.99	.66
600	30.5	2.33	148	174	14	.67
800	32	3.11	158	179	19.5	.63
1,000	32.5	3.87	145	165	24.67	.63
1,200	31.75	4.45	143	162	29.03	.61
1,400	30.25	5.02	136	155	32.27	.62
1,600	27.5	5.51	135	153	33.38	.66

A special test run of 15 minutes with throttle in one-half-open position was made at 1,000 revolutions per minute. The horsepower was 23.90 and fuel consumption .69 pound per horsepower hour.

The general arrangement of the Longuemare carbureter is shown in Figs. 2 and 3, Fig. 2 showing the throttle in a closed position for idling and Fig. 3 the open position. The fuel supply is controlled by a conventional float, and from the float chamber it passes through the passage C and is controlled by the regulating valve M, which regulates the opening into D, which leads into the large channel H, communicating with both jets. The fuel also flows back into the compensating chamber A, through the channel E to the same level as in the float chamber, and the working jet I.

With the throttle closed, the mixture enters through the opening, N, and thence into the space Y above the throttle through the opening O. The latter is regulated by a small set screw on the outside of the throttle chamber.

In this position of the throttle fuel can only flow through the superimposed idling jet K, the fuel being supplied through a

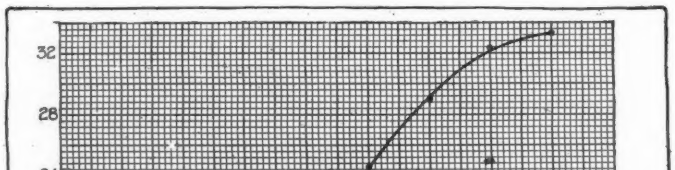


Fig. 1—Curve showing brake horsepower and fuel consumption plotted against revolutions per minute. The horsepower output curve is practically straight up to 1,200 revolutions per minute. It will be noted that the fuel consumption curve is nearly flat.

small tube which extends well below the fuel level in the working jet I.

The nozzle of the idling jet K extends well into the strangling passage Z. To the left of the strangling passage is a small air inlet J, the opening of which can be regulated by the ratchet lock thumb screw R. Thus air can enter only in the confined space around the nozzle K and through J.

When the motor starts and runs slowly with this throttle position it draws air with great velocity past the idling jet K and through J, the velocity past K being regulated according to the thumb screw R, this giving a very close regulation for idling.

When the throttle is opened, Fig. 3, either slowly or quickly, the suction around the jet I increases rapidly but diminishes around the jet K. Under these conditions the compensating chamber augments the flow from the compensating chamber A and empties into the common supply chamber H to E.

Thus the additional fuel required for a pick-up is instantly supplied. When the motor is slowed down this compensating chamber A again becomes partially filled with gasoline.

The tendency of the mixture to become over-rich on the higher speeds is overcome in the following way: When the throttle is opened slowly or rapidly the chamber A is quickly drained, this allowing air to enter the orifice E by way of the orifices F, which air is immediately drawn by way of the passage E into the passage H. Air being a lighter medium, partially displaces the fuel passing through it and thus retards the increase in flow from A. In this manner an automatic fuel regulation is obtained.

The passage of air through the opening E into the fuel channel H results in forming an emulsion, which is drawn through the multiple passages G of the working jet I and impelled against the diffusing shoulder S. This highly saturated vapor is mixed in the correct proportion with the air entering from the main air opening X by way of the choke tube Q.

A nickel steel needle operated by the push button W below the working jet is provided to clear the idling jet K of any obstructions that might lodge therein.

Duplex Governor Limits Both Car and Motor Speed

Centrifugal Governor Driven by Both Engine and Drive Shaft—Placed Between Carbureter and Manifold—Throttles Mixture

HERETOFORE governors have been designed either to limit the maximum speed of the car or the motor, but a governor just placed on the market by the Duplex Engine Governor Company, New York City, does both. It prevents a reckless chauffeur from running the car at too high a speed on high gear, and at the same time prevents the racing of the motor when traveling on intermediate speeds. The Duplex instrument, Fig. 1, is inserted between the carbureter and the intake manifold, and consists of a fly-ball governor which acts on a throttle valve of the gridiron type. This governor is driven by two shafts, one running to the propeller shaft and the other being driven from the engine. These shafts transmit their power to the governor shaft through spur gears, the driving gears of each of these shafts being provided with over-running clutches so that whichever driving shaft happens to be traveling at the higher speed drives the governor.

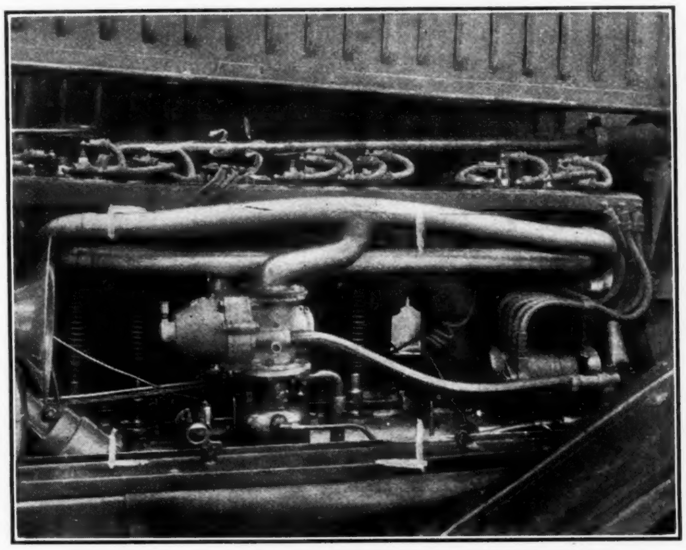


Fig. 1—Duplex governor installed on six-cylinder motor

The governor construction is clearly illustrated in Fig. 2, the upper view showing a horizontal section through the governor axis, and the lower a vertical section through the axis. Looking at the upper view, it will be noted that the transmission driving shaft is located at the top and the engine driving shaft at the bottom, and that these shafts drive the governor gear A through the spur gears B and C. As already stated, the gears B and C are attached to their respective shafts through over-running clutches. As the speed of the governor increases, the weights fly out, and this closes the gridiron valve by drawing the member D to the left. This member carries the pin E which pushes the rod F to the left, and this rod acts on the throttle valve through the rod G. The object in using a gridiron valve is to reduce the movement required from full opening to full closing of the intake passageway. The travel of this valve is only 1/8 of an inch, so its movement can be very rapid. When this valve is open the passages have the shape of a venturi tube, being contracted at the center, and it is claimed that this form adds materially in the thorough mixing of the fuel as it passes to the motor.

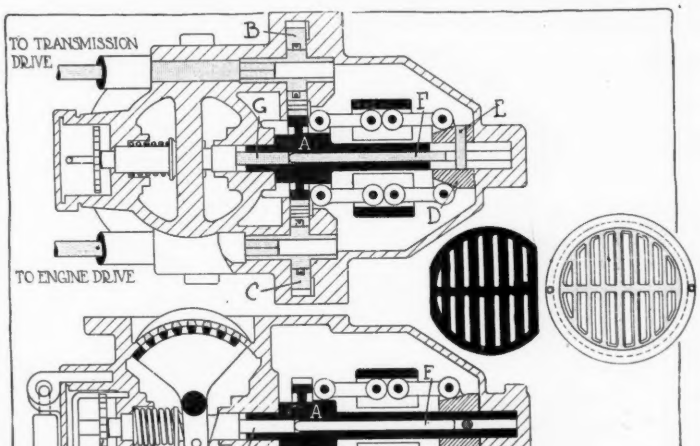


Fig. 2—Upper view, horizontal section through governor. Lower view, vertical section through governor. At right, plan view of gridiron valve

The speed at which the governor valve closes can be varied by varying the tension on the spring H by turning the wheel J. The tension of this spring must be overcome by the centrifugal force of the governor weights before the valve can be moved. In other words, the pressure due to centrifugal force on the rod F must be slightly greater than the pressure in the opposite direction produced by the spring before there will be any tendency for the governor weights to move the valve. The adjusting wheel is held in position by a locking yoke, and the wheel is inclosed and can be locked up so that it cannot be tampered with.

TABLE SHOWING LAP TIMES MADE IN THE AMERICAN GRAND PRIX RACE HELD

No.	Car	Driver	Lap 1	Lap 2	Lap 3	Lap 4	Lap 5	Lap 6	Lap 7	Lap 8	Lap 9	Lap 10	Lap 11	Lap 12	Lap 13	Lap 14
4	Mercer	Pullen	6:16	.....	18:57	25:17	31:25	37:32	43:47	49:52	55:55	1:01:56	1:07:56	1:14:01	1:20:06	1:26:07
17	Marmon	Ball	6:50	13:10	19:40	26:11	32:43	39:14	45:45	52:15	58:48	1:05:26	1:12:10	1:18:53	1:25:35	1:32:18
6	Alco	Taylor	6:30	14:51	22:01	29:11	36:24	43:39	50:48	57:50	1:05:02	1:12:08	1:19:16	1:26:26	1:33:31	1:40:37
12	Mercedes	De Palma	.....	13:11	19:32	25:47	32:09	38:40	44:58	51:21	57:37	1:03:57	1:10:15	1:16:35	1:22:56	1:29:13
9	Mercer	Gordon	7:20	14:06	20:50	27:33	34:08	40:58	47:46	54:34	1:01:24	1:08:10	1:15:02	1:21:52	1:28:46	1:35:40
3	Stutz	Anderson	6:39	.....	19:36	25:56	31:58	38:14	44:56	50:49	57:07	1:03:24	1:09:40	1:15:56	1:22:11	1:28:25
7	Mercer	Oldfield	6:27	.....	18:52	25:06	31:09	37:22	43:29	49:44	58:15	1:04:35	1:10:46	1:16:54	1:23:03	1:29:16
20	Mason	Rickenbacher	7:03	13:42	24:18	30:50	37:32	44:03	50:35	57:07	1:03:42	1:10:15	1:16:45	1:23:19	1:30:01	1:36:50
14	Sunbeam	Marquis	.....	13:37	19:57	26:06	32:24	38:42	45:22	51:44	58:01	1:04:23	1:10:41	1:16:59	1:23:16	1:29:41
15	Marmon	Muth	7:28	14:31	21:26	28:13	35:18	42:09	49:02	55:42	1:02:35	1:09:22	1:16:10	1:23:00	2:05:10	2:11:59
19	Alco	Janette	7:25	.....	21:20	28:09	35:14	42:15	49:07	56:03	1:02:53	1:09:46	1:16:36	1:23:24	1:30:13	1:36:57
2	Mercer	Wishart	6:15	12:12	18:10	24:07	30:01	35:58	43:00	47:50	53:47	59:44	1:05:41	1:11:35	1:17:33	1:23:33
16	Fiat	Lewis	7:02	13:23	20:11	29:15	35:50	42:58	51:07	57:50	1:04:38	1:11:23	1:20:12	1:29:10	1:35:56	1:42:32
1	Fiat	Tetzlaff	6:15	12:32	19:58	25:54	31:36	37:24	43:26	51:04	58:28	1:04:22	1:10:16	1:16:05	1:21:57	1:27:51
11	Apperson	Goode	.....	13:36	20:19	27:46	34:30	41:15	47:55	56:26	1:03:03	1:09:38	1:16:12	1:22:47	1:29:24	1:36:03
8	Stutz	Cooper	6:46	13:18	19:44	26:01	32:49	Out on sixth lap								
18	Fiat	Verbeck	7:02:30	Out on second lap												

Santa Monica Drivers Get $5,000 Extra

Big Races a Success Financially—California Wants Races Next Year—Details of the Contests

LOS ANGELES, CAL., March 6—Aftermath of the Santa Monica road race meet of the Western Automobile Assn. reflects great credit on the promoters and shows that, properly handled, the two great classics can be run with profit, both financially and from the sport viewpoint. Whereas Chairman Shettler guaranteed only $15,000 in prize money for the Vanderbilt and Grand Prix, yet when the final count was made it was discovered that the drivers could split $20,000. Be it understood also that the Western Automobile Assn. is so organized that it cannot keep the money it makes, which accounts for this extra division of the profits of the late meet among those who furnished the show—the drivers.

Meet Handled Well

The meet was handled most efficiently and there were only two accidents, one in each race. In the Vanderbilt Pullen blew a tire on Death Turn which upset him and in the Grand Prix, at the same spot, Marquis in the Sunbeam, turned turtle. The latter accident resulted in injuries to both driver and mechanic. Marquis, who was hurt more seriously than his mate, is coming along nicely, though, and soon will be himself. The course was well guarded, the spectators in the stands were kept advised of the progress of the race by means of the Pendleton score board which showed positions instead of time, while in every other department Chairman Shettler was most successful in having his plans carried out.

With at least 100,000 persons at each race, naturally the Californians are impressed with the possibilities of the future and if the two classics ever leave the coast it will be surprising. Indeed, there is a strong movement on hand right now to keep both of them here for next year. San Francisco wants one of the races at least and Los Angeles the other. It is pointed out that the 1915 exposition should have such a motoring attraction and the San Francisco delegation that attended the race banquet last Saturday night presented arguments why it should have one of the races.

It is suggested that Los Angeles keep the Vanderbilt and let San Francisco have the Grand Prix. The Western Automobile Assn. could stage the Vanderbilt in the early spring, while the Grand Prix could be run in the fall. The exposition authorities have endorsed the appeal of San Francisco and it is said that Golden Gate park can be secured for a race course.

Looking back over the races themselves, one finds that there was keen competition in both, although the finish of the Grand Prix, in which Pullen was some 40 minutes ahead of the next car, Ball's Marmon, might indicate otherwise. As a matter of fact few races have been harder fought than the 1914 Grand Prix. Had the machines stood up the finish would have been hair-raising.

Up to the end of the twenty-second lap, when a burnt-out

Table Showing Lap Times Made in

No.	Car	Driver	Lap 34	Lap 35	Lap 36	Lap 37	Lap 38
4	Mercer	Pullen	3:37:11	3:43:18	3:52:22	3:58:39	4:05:07
17	Marmon	Ball	4:16:00	4:22:38	4:29:18	4:35:57	4:32:35
6	Alco	Taylor	4:17:42	4:25:13	4:32:42	4:40:04	4:47:28
12	Mercedes	De Palma	3:55:53	4:07:08	4:45:38	4:52:33	4:59:35
9	Mercer	Gordon	5:32:33	5:39:57	5:47:11	5:54:38	6:02:56
3	Stutz	Anderson	3:40:21	3:49:58	3:56:29	4:02:52	4:09:21
7	Mercer	Oldfield	3:42:09	3:48:57	3:55:29		
20	Mason	Rickenbacher	Out on thirty-fourth lap				
14	Sunbeam	Marquis	Out on thirty-third lap				
15	Marmon	Muth					
19	Alco	Janette					
2	Mercer	Wishart					
16	Fiat	Lewis					
1	Fiat	Tetzlaff					
11	Apperson	Goode					
8	Stutz	Cooper					
18	Fiat	Verbeck					

TABLE SHOWING THE POSITION BY LAPS OF THE CONTESTANTS IN THE AMERICAN GRAND

No.	Car	Driver	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
4	Mercer	Pullen	2	..	3	3	3	4	4	3	2	2	2	2	2	2	2	2	2	2	2	6
17	Marmon	Ball	6	..	6	9	8	8	8	8	8	8	8	8	8	8	8	8	8	7	12	12
6	Alco	Taylor	4	..	15	14	15	14	14	14	15	15	14	14	13	13	13	13	13	11	10	10
12	Mercedes	De Palma	..	..	4	4	6	6	6	6	4	4	4	5	5	5	6	5	5	4	4	3
3	Stutz	Anderson	5	..	5	6	5	5	5	4	3	3	3	3	4	4	4	6	7	6	5	5
9	Mercer	Gordon	..	..	12	10	10	9	9	9	9	9	9	9	9	9	9	10	10	8	7	7
7	Mercer	Oldfield	3	..	2	2	2	2	3	2	6	7	7	6	6	6	5	4	4	3	3	2
20	Mason	Richenbacher	9	..	..	16	16	16	15	13	13	13	13	13	12	11	11	11	11	9	8	8
14	Sunbeam	Marquis	..	..	8	8	7	7	7	7	5	6	6	7	7	7	7	7	6	5	5	4
15	Marmon	Muth	..	..	14	13	13	11	11	10	10	10	10	11	15	15	15	14	15	13	13	13
19	Alco	Janette	10	..	13	12	12	12	12	11	11	12	12	13	12	12	12	12	12	10	9	9
2	Mercer	Wishart	1	..	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
16	Fiat	Lewis	7	..	10	15	14	13	15	14	14	14	15	15	14	14	14	15	14	12	11	11
1	Fiat	Tetzlaff	1	..	9	5	4	3	2	5	7	5	5	4	3	3	3	3	3			
11	Apperson	Goode	..	..	11	11	11	10	10	12	12	11	11	10	10	10	10	9	9			
8	Stutz	Cooper	..	..	7	7	9															
18	Fiat	Verbeck	8																			

ON THE SANTA MONICA COURSE, LOS ANGELES, CAL., SATURDAY, FEBRUARY 28

Lap 15	Lap 16	Lap 17	Lap 18	Lap 19	Lap 20	Lap 21	Lap 22	Lap 23	Lap 24	Lap 25	Lap 26	Lap 27	Lap 28	Lap 29	Lap 30	Lap 31	Lap 32	Lap 33
1:32:12	1:38:07	1:44:05	1:50:03	1:56:03	2:08:29	2:14:38	2:20:36	2:26:40	2:32:43	2:38:54	2:44:57	2:51:04	2:57:13	3:06:25	3:12:38	3:18:51	3:24:53	3:30:59
1:38:39	1:45:08	1:51:58	1:58:56	2:31:42	2:42:05	2:48:26	2:54:52	3:01:15	3:07:40	3:14:05	3:20:35	3:27:01	3:33:27	3:41:00	3:49:37	3:56:05	4:02:95	4:09:23
1:47:47	1:55:57	2:02:09	2:09:22	2:16:52	2:24:10	2:31:32	2:39:05	2:39:05	2:57:36	3:05:02	3:12:47	3:22:35	3:30:02	3:37:25	3:44:51	3:52:17	3:59:42	4:10:11
1:35:27	1:41:46	1:48:09	1:54:23	2:00:42	2:07:04	2:13:24	2:19:43	2:25:59	2:31:18	2:38:37	2:45:00	2:51:21	2:57:37	3:03:59	3:12:07	3:20:06	3:27:19	3:37:03
1:42:34	1:49:20	1:56:21	2:03:27	2:10:28	2:17:27	2:24:28	2:31:26	2:38:23	4:08:25	4:26:38	4:33:52	4:41:05	4:48:22	4:55:45	5:03:01	5:10:17	5:17:40	5:25:11
1:34:41	1:42:12	1:48:41	1:55:03	2:01:25	2:07:47	2:14:08	2:20:29	2:26:48	2:33:08	2:39:27	2:45:48	2:52:06	2:58:26	3:04:45	3:11:03	3:20:56	3:27:25	3:33:51
1:35:25	1:41:36	1:47:43	1:53:52	2:00:05	2:06:22	2:14:07	2:20:31	2:27:05	2:33:24	2:39:38	2:45:54	2:53:25	2:59:40	3:05:46	3:14:53	3:21:13	3:27:31	3:34:00
1:43:32	1:50:25	1:58:01	2:04:29	2:11:04	2:17:32	2:24:00	2:29:33	2:37:05	2:43:24	2:49:47	2:56:10	3:02:33	3:09:00	3:15:24	3:21:58	3:32:46	3:41:34	3:52:58
1:36:00	1:42:19	1:48:39	1:54:39	2:01:17	2:07:36	2:13:51	2:20:18	2:26:36	2:32:52	2:39:09	2:45:27	2:51:44	2:58:01	3:04:17	3:10:37	3:16:51	3:23:03	
2:18:51	2:36:17	3:00:02	3:08:56	3:15:52	3:22:47	3:29:51	3:36:47	3:43:44	3:50:48	Out on twenty-fifth lap								
1:43:08	1:51:15	2:00:37	2:07:13	2:14:07	2:20:57	2:27:54	2:34:08	2:41:51	Out on twenty-fourth lap									
1:29:30	1:35:25	1:41:20	1:47:17	1:53:11	2:00:09	2:06:19	2:12:26	Out on twenty-third lap										
1:49:11	1:58:37	2:07:02	2:13:46	2:20:14	2:26:44	2:33:33	Out on twenty-second lap											
1:33:47	1:39:38	1:45:37	Out on eighteenth lap															
1:42:36	1:49:15	1:56:18	Out on eighteenth lap															

the American Grand Prix (Continued)

Lap 39	Lap 40	Lap 41	Lap 42	Lap 43	Lap 44	Lap 45	Lap 46	Lap 47	Lap 48
4:11:23	4:20:32	4:27:11	4:33:43	4:40:01	4:46:17	4:32:47	4:59:34	5:06:33	5:13:30
4:49:23	4:56:09	5:02:57	5:09:49	5:17:48	5:26:00	5:32:52	5:39:32	5:46:20	5:53:23
4:54:57	5:02:59	5:14:14	5:21:42	5:29:10	5:36:36	5:49:02	5:52:48	6:00:47	6:08:29
5:06:32	5:13:47	5:20:57	5:27:53	5:34:95	5:41:37	5:48:31	5:55:25	6:02:17	6:09:08
6:09:06	6:16:48	Out on forty-first lap.							
4:15:48	4:22:17	4:28:41	4:35:07	4:41:31	4:50:27	Out on forty-fifth lap			
Out on thirty-seventh lap									

bearing forced his retirement, Wishart seemed a certain winner, having 7 minutes 9 seconds lead over DePalma, who was runner-up. He was hitting close to 84 miles per hour, much faster than the Vanderbilt pace up to this point. Bunched back of him were five of his rivals—DePalma, Marquis, Anderson, Oldfield and Pullen in the order named—and it is a remarkable fact that there was a difference of only 53 seconds between DePalma second, and Pullen, sixth. Wishart led for the first twenty-two laps, giving way to DePalma, who led for seven laps, being stopped by a broken intake valve at the twenty-ninth lap. Then the Vanderbilt hero went to the front and he led Marquis by only 23 seconds, when he slowed in the twenty-ninth, with Anderson third, Oldfield fourth and Pullen fifth. Between first and fifth there was a difference of 4 minutes 31 seconds.

Marquis forged ahead, when DePalma developed valve trouble and when he turned turtle in the thirty-third he had accumulated a lead of 1 minute 50 seconds over Pullen, who had climbed to second. DePalma, Anderson and Oldfield were a little more than 2 minutes back of Pullen, DePalma being 6 seconds ahead of Anderson and Gil 6 seconds ahead of Oldfield.

At the end of the thirty-third lap Pullen was 2 minutes 51 seconds ahead of Anderson, who was 9 seconds in front of Oldfield, with DePalma laboring 23 seconds back of Barney. After this, though, the eliminations came fast and after the forty-fourth lap Pullen had absolutely no competition. Anderson, the last of the speedy ones, was marooned in the back stretch and there was nothing left for Pullen to do but finish.

After his demonstration in the Grand Prix, the critics were convinced that DePalma would have had a hard fight to have beaten the Mercer star in the Vanderbilt had it not been for the upset on Death Curve. It will be remembered that while he lasted in the first classic, Pullen was hitting a merry clip and had accumulated a lead of about 4 minutes when he went out in the thirteenth lap. Following this, Anderson enjoyed the sensation of leading the field for four laps. Then DePalma went to the front, following Gil's elimination, leaving Oldfield the only one with a chance. Tire trouble, though, shunted Barney into second place, but the veteran had the satisfaction of knowing that the 1914 Vanderbilt was the best race he ever drove.

Chicago May Have 2-Mile Speedway

CHICAGO, ILL., March 9—The Chicago Motor Speedway Assn. is the latest announcement, with D. F. Reid as president and John H. Palmer as secretary and treasurer. This association has purchased 500 acres of land near Flossmoor, some 28 miles from Chicago on the Illinois Central, and proposes to erect a 2-mile concrete speedway, which it is hoped to have ready for racing in the fall. The turns are to be 75 feet in width and the straights 60 feet. The grandstand will hold 100,000 and there will be parking space for 25,000 cars. The capital stock of the association is $1,000,000, all stock being common and non-assessable, of the par value of $10 a share. Palmer is identified with the industry and at one time was the Lozier agent here.

More racing is planned for Chicago, application having been made by David T. Alexander, representing the interests that own Hawthorne track, for two sanctions for dirt track meets next summer. He wants July 4 and 5 and September 6 and 7. He proposes to put the old course in the finest shape possible and to stage a long distance race on July 4 for which a purse of from $7,500 to $10,000 will be offered.

PRIX RACE HELD ON THE SANTA MONICA COURSE AT LOS ANGELES, SATURDAY, FEBRUARY 28

21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48
6	6	3	3	3	3	3	3	5	4	3	3	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
12	11	10	8	8	8	8	8	8	8	8	8	6	5	5	4	3	3	3	3	3	3	3	3	2	2	2	2
10	10	8	7	7	7	7	7	7	7	7	7	7	6	6	5	4	4	4	4	4	4	4	4	3	3	3	3
2	2	1	1	1	1	1	1	1	2	2	2	4	4	4	6	5	5	5	5	5	5	5	5	4	4	4	4
5	4	4	4	4	4	4	4	3	3	4	4	2	2	3	3	2	2	2	2	2	2	2	2	2			
8	8	7	10	9	9	9	9	9	9	9	9	8	7	7	7	6	6	6	6								
4	5	5	5	5	5	5	5	4	5	5	5	3	3	2	2												
7	7	6	6	6	6	6	6	6	6	6	6	5															
3	3	2	2	2	2	2	2	2	1	1	1																
13	12	11	9																								
9	9	9																									
1	1																										
11																											

The AUTOMOBILE

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"Little Drops of Water"

LITTLE drops of water and little grains of sand, still continue to make the mighty ocean and the beauteous land, although a few makers by their manufacturing and merchandising methods give every indication that they never heard of these old-fashioned lines.

Our big makers learned them by heart in their childhood, and if they did not arrange the words in this exact form then, they had the spirit of them embedded so deeply in their gray matter, that the mere arrangement of words was very secondary. They had not only imbibed their meaning but had carved their very spirit into the warp and woof of their business existence.

No big organizations can get along without practically applying the homely thoughts in these lines. The big production plant must study the little things, call them drops of water, grains of sand or what you like, from morning to night, from week beginning to week ending, from the first to the last of the month and from January 1 to December 31.

This motion study, for it is merely this under another name, is studied every hour of the working day in every department of the factory. It is this that makes it possible to cut down prices, add to the quality and to sell big productions. So important is motion study that our most successful companies have studied in their assembly work the proper placing of tool racks so that their workmen will not throw their tools on the floor and later have to expend good physical energy stooping and picking them up, before they can finish the job or start on a duplicate one.

Motion study experts have demonstrated, nay, they have proven that stooping is the most extravagant movement the workman has to go through in the day's occupation. So small is it, we have all been accustomed to doing it from the day we started walking, and yet it is disastrous. It has been the factor that has written Failure and Receivership across the statements of several of our companies that tried to do business without the little drops of water or the little grains of sand.

In trades as old as bricklaying motion study came forward and demonstrated that a man carrying the hod filled with bricks could do over 30 per cent. more work in a given day if he did not have to needlessly stoop as compared with the other workman in the same job, who had to bend his back to pick up the filled hod.

If bricklayers could add 40 per cent., in some instances as high as 70 per cent., more efficiency to a trade as old as the pyramids, then what boundless opportunity is knocking at the doors of our automobile factories in these days when production is the word written on the standard that flutters over some of our factories during the 24 hours of the day, and over others from the rising of the sun to the setting thereof.

The Wind Resistance Factor

THAT it takes more horsepower to overcome the wind resistance of a car traveling 40 miles per hour than it does to drive the car on the level road, as demonstrated recently at Brooklands track, should convince a few makers of high-power machines, cars they claim make 60 miles per hour or over, that it is almost as good policy to cut down the wind-resisting surface as to add cubic displacement in the motor.

Cutting down wind resistance is as positive a method of increasing useful power as increasing horsepower. Builders of racing cars discovered this some years ago, and the high-speed track records of today owe nearly as much credit to cutting down the front area of the machine and developing a streamline effect, as they do to the improvements in motors. Unless the two are combined to some extent it is well nigh impossible to obtain the results that have been achieved at Brooklands and at other places.

The recent experiment of a French cyclist, who found that he could travel faster on his machine by building an egg-shaped body around himself than by riding in the ordinary form, proves that it is streamlines that do much, in fact, that make the records.

The reduction of wind-resistance has received little, if any, consideration at the hands of our body designers today, yet it is a factor that should be considered, one that will give little benefit at low speeds, but that will be an economy factor at all speeds over 25 miles per hour.

Manufacturers are only beginning to realize to what extent projections above the streamline surface cut down the speed of their cars. The accessories have long been carried in unsightly places and now at last light is breaking through the clouds on this and we rarely find lamps which are carried out at the sides on clumsy brackets, tires are in the rear and often under cover. In fact, streamlines and sightliness are complementary.

Production in Detroit for February Establishes New High Mark

In Spite of Severe Weather and Other Harassing Conditions, 35,900 Passenger Cars Were Built, of which Ford Produced 24,476

DETROIT, March 3—The city's total production of motor vehicles of all classes for the month of February was 36,890, which figure is accurately compiled from production statements furnished by each of Detroit's factories individually. Nearly thirty concerns contributed to this large production. Of course the predominating class of vehicle is the passenger car, of which there were 35,900 manufactured during February. The commercial car total was 540, while the electric vehicle makers contributed several hundred more.

In the passenger vehicle total Ford naturally figures very prominently, having produced during February 24,476 cars. This is a record month for the big company just as January of this year was. However, February, with only twenty-four actual working days, saw more cars turned out of the Ford plant than January. Figuring on the twenty-four working days, the actual production of Fords was 1,020 cars per day average.

Studebaker, Cadillac, Hudson, Chalmers, Hupmobile, Maxwell, Paige-Detroit were also very heavy producers, and each reports exceedingly favorable conditions.

The general reply to the question as to how February's production this year compared with the corresponding month a year ago, was that the month just past was far ahead of a year ago, this despite the fact that the present February was a very severe one.

PORTLAND, ORE., March 8—The regular business meeting of the Portland Automobile Dealers' Assn., was held March 4 and a 32 per cent. dividend was declared on the recent automobile show, which was a great success in every way.

New Automobile Liability Rates

NEW YORK CITY, March 10—The London & Lancashire Guarantee & Accident Co., has issued a revised schedule of automobile liability insurance rates. The new rates are from \$2 to \$5 below the conference figures, the greatest cut being on the higher powered cars. The revision in rates only applies to private pleasure cars, and for Greater New York start on the basis of \$35 for 16 horsepower cars with \$3 increase for each additional horsepower up to 19; \$48 for 30 horsepower; \$50 for 21 horsepower, and then \$3 increase per horsepower up to 26 horsepower, and \$2 increase thereafter up to 30 horsepower. From then on the increase is \$1 per horsepower up to 55, all above that, taking a rate of \$100.

Driving Cyclecars in New Jersey Illegal

NEW YORK CITY, March 10—A curious situation has arisen in New Jersey in regard to cyclecars. These vehicles are, by definition, of less than standard tread. An old law of 1787 still on the statute books of the state makes it a penal offense to drive a vehicle with a gauge of less than 4 feet 10 inches, providing a fine of 20 shillings in punishment for violation. As a matter of fact, this law, which apparently escaped the revision of New Jersey's laws in 1868, makes it illegal to drive even the ordinary automobile, for the standard automobile tread is 4 feet 8 inches, while the most common cyclecar tread is 3 feet. The matter is to be brought to the attention of the Legislature, and a bill to repeal it has been written by Assemblyman Griffin.

J. I. Case Co.'s Income \$2,002,278

NEW YORK CITY, March 11—The report of the J. I. Case Threshing Machine Co. for the year ended December 31, 1913, shows net earnings of \$2,002,278, against \$2,770,773 in 1912. After deducting interest charges amounting to \$733,627, there was a balance available for dividends of \$1,268,651. The remainder of \$418,151 after paying 7 per cent. on the preferred stock, was equal to 5.03 per cent. on the common stock as compared with 17.03 per cent. earned the previous year.

Kardo Co. To Control Axle Patent Situation

DETROIT, MICH., March 9—The Kardo Co., recently incorporated in Ohio with headquarters at Cleveland and having a capitalization of \$1,000,000, looms up as one of the most important of patent holding companies in the automobile industry, and has as its officers and directors very prominent figures in the motor car field. Alvan Macauley, vice-president and general manager of the Packard Motor Car Co. heads the new Cleveland organization, and T. W. Frech of the Peerless is vice-president; and F. C. Dorn, American Ball Bearing Co., is secretary and treasurer. Besides these men, the board of directors of the Kardo Co. includes Milton Tibbetts, patent counsel of the Packard company, F. S. Terry, of the Peerless company, and Walter C. Baker, of the American Ball Bearing Co.

Although the Kardo Co. is incorporated for the purpose of "acquiring, owning and dealing in vehicle patents," its chief concern at this time is with the axle patents of the Packard Motor Car Co., the Peerless Motor Car Co., and the American Ball Bearing Co. These patents have so overlapped and dovetailed one another that some sort of holding company for all of them was necessary to prevent litigation among the three concerns above named. By the transfer of all patents to the Kardo Co., protection is thus gained for all, since all can use the patents of all without conflict.

The formation of this holding concern for these axle patents makes a very strong combination, and since all other axles are said to be infringements of one or more of these patents, it is pointed out that other makers will either have to take out licenses or lay themselves open to litigation.

In a statement issued recently the Kardo Co. says of these patents:

"The patents are now owned by the Kardo Co. Some licenses under them have been granted and the company is negotiating others at the present time. Of course, the usual royalty reservations will be made, and manufacturers will receive licenses that will insure them the right to make and sell to their customers axles that are free from charges of infringement."

The Kardo company holds eight patents as follows: 608,017, dated July 26, 1898, to W. C. Baker, on an anti-friction bearing for use in a front axle; 664,478, December 25, 1900, Hopewell patents, rear axle on removable pinion mounting; 705,304, July 22, 1902, Sangster patent of Packard company, which covers broadly adjustment of bevel gears; 783,168, February 21, 1905, Baker rear axle patent; 792,690, June 20, 1905, on bevel gear drive and compensating mechanism; 950,191, February 22, 1910, on adjustment bevel gearing—this is an improvement on the Sangster patent; 1,013,450, January 2, 1912, on rear axle transmission, and also the re-issue 12,966, June 1, 1909, on power transmission mechanism for automobiles which covers Peerless rear axle with universal joints and removable features.

Iron and Steel Division Meets

NEW YORK CITY, March 10—The good resulting from the announced schedule of committee meetings for divisions of the standards committee of the Society of Automobile Engineers was shown at the meeting of the Iron and Steel Division held here today. Extensive plans for the future were made and the division expects to report considerable progress at the coming Summer meeting at Cape May. Seven members of the division were present and two attended by proxy. Those who attended were as follows: Henry Souther, chairman; E. F. Russell, C. F. W. Rys, R. Furness, Thomas Towne, F. W. Trabold, K. W. Zimmerschied and H. J. Slagg, Jr., representing J. A. Mathews, and D. A. Capen representing E. L. French.

Court Refuses To Enjoin Klaxon Makers

Request for Preliminary Injunction by Johns-Manville Denied by Judge Lacombe

NEW YORK CITY, March 10—The application for a preliminary injunction restraining the Lovell-McConnell Mfg. Co. from interfering with the H. W. Johns-Manville Co.'s advertising contracts and from issuing advertisements threatening infringement suits against dealers, agents and users of the Long horn, has been denied by Judge Lacombe, in the U. S. Circuit Court of Appeal. The request for a preliminary injunction arose from a notification sent out by the Lovell-McConnell company that it would cancel its advertising contracts with any publisher who printed, subsequent to notification, any advertisement of the Newtone, Sparton and Long horn. The request was brought January 14, 1914. By the decision of the Court, the Lovell-McConnell company has the authority to cancel its contracts for the cause mentioned.

In THE AUTOMOBILE for February 26, it was stated that the Goodrich net profits for the year 1913 equal 83 per cent. on the $60,000,000 common stock, after the $2,100,000 preferred dividend had been deducted. This was a typographical error, as the figures should have been .83 per cent.

NEW YORK CITY, March 10—The preliminary injunction against the Garland Auto Co., which used Sparton horns, will stand according to a memorandum of Judge D. J. Hough in the U. S. District Court for the Southern District of N. Y. No final appeal will be entered in that court until the appeal of the Newtone people in Judge Chatfield's case in Brooklyn is decided. This will probably be brought up for a hearing in the first part of April.

Judge Hough said, "In my opinion the interpretation given to the patents by Judge Chatfield is such as to make the horn before me an infringing article because of a wheel having teeth capable of producing a camming effect struck in quick succession on the wear piece of a diaphragm.

"In my judgment, the Sparton horn does show a camming process. This case must take the same course as did the one of the Eastern District if the latter case be approved."

Jail Now for New York Speeders

NEW YORK CITY, March 11—Alderman Carroll's ordinance, making it necessary for chauffeurs convicted of violation of the speed ordinance to receive a prison sentence and to spend at least one night in jail, was adopted yesterday. The ordinance provides a minimum fine of $25 or 2 days in jail, with a maximum of $100 or 15 days in jail.

Sues Tire Concerns for $450,000

NEW YORK CITY, March 11—That the government has been investigating the alleged conspiracy of five large rubber manufactories to eliminate the Automobile Co-operative Association of America was asserted today by Howard H. Williams, counsel of the association, which filed suit for $450,000 damages in Cleveland Monday in the U. S. Court.

The defendants are B. F. Goodrich Co., Akron, O., B. F. Goodrich Co., New York, Diamond Rubber Co., Akron, O., Firestone Tire & Rubber Co., Akron, O., Republic Rubber Co., Youngstown, O., and the United States Tire Co., New York, and the officers of each of these concerns.

The petition charges a conspiracy and combination in restraint of the rubber trade, resulting in the alleged destruction of the business of the co-operative association, which closed its doors in November, 1911, after losing a capital of $75,000 and estimated profits of $75,000. Basing the suit on the Sherman anti-trust act, the plaintiff asks for three times the total loss, or $450,000.

The association brought suit through its president, Wm. C. Dickerman, who also is vice-president of the American Car & Foundry Co. Attorneys representing are Mr. Williams of New York, James A. Fowler of Knoxville, Tenn., and O. E. Harrison, of Columbus, O.

It is alleged in the petition that manufacturers refused to sell to the co-operative association and influenced bigger jobbers to cut off supplies; that they organized a dealers' protective association operated by their own "agents, spies, and detectives" to learn who sold the association its products; also, that a boycott and blacklist was maintained to help destroy the association.

According to Mr. Williams, the association had 1500 members who paid the yearly membership fee of $5, which was of the nature of stock on which a dividend was to be paid. It was organized in June, 1908, and was modelled after an English association of a similar co-operative nature. To finance itself $75,000 in bonds were sold to various persons, mostly stock-holders. An office in New York and Philadelphia was maintained. Mr. Dickerman was president for the three years.

"All of our charges are specific and well supported by evidence," Mr. Williams said to a representative of THE AUTOMOBILE.

Thomas L. Robinson, President of the Republic Rubber Co., Youngstown, O., stated today that he did not even know of the Automobile Co-operative Association of America, and that his company was ignorant of the entire matter.

Barber Brings Suit on Valve Patent

NEW YORK CITY, March 6—William Barber, a Brooklyn inventor has brought suit against G. B. Foster, the Buick dealer in Yonkers, claiming an infringement on a valve patent, No. 781,-802, granted to him February 7, 1905. His patent, according to Barber, covers a removable valve, of which the four-cylinder cars involved in the present suit have eight, all of the overhead type. The point at issue, however, is their removability and the overhead position. He claims that Foster has sold a number of cars incorporating this construction and asks for $800 in damages.

Proposed Change in Freight Rates Means $500,000 Loss Annually to the Industry

NEW YORK CITY, March 10—According to J. S. Marvin, General Traffic Manager of the National Automobile Chamber of Commerce, Inc., the most important matter relating to freight rates that has been suggested in some time is the proposal, or suggestion, that has come before the Interstate Commerce Commission, that the railroads assess a separate charge for the so-called "spotting" of freight cars, which apparently means placing them on the sidings of factories having private sidings. Mr. Marvin says:

"This has come up in connection with the proposed increase of 5 per cent. in freight rates on eastern railroads, as a means of producing sufficient additional revenue, instead of increasing the freight rate itself, and in the event that the Interstate Commerce Commission decides that the railroads have made out a case which entitles them to a general increase in their transportation charges. This plan, if adopted, would inaugurate an entirely new principle of rate-making, inasmuch as it would separate the charges for the line haul from the terminal charges. Involved in this question are also the services provided by railroads in the loading and unloading of many kinds of freight, lighterage charges and the delivery of accumulated lots of less carload freight in the so-called "ferry cars."

All of these services have heretofore been included in the freight rate to or from the cities in which the factories are located. Shipping interests appeared before the Interstate Commerce Commission at Washington, February 27 to March 4, giving evidence which would tend to show that factory terminals are an advantage to carriers and that the handling of carload lots to and from these sidings cannot be properly designated as free service. Shippers were a unit against the plan.

Fuel Test for France—$12,400 in Prizes

PARIS, FRANCE, Mar. 6—The Automobile Club of France is planning to hold a series of tests of kerosene engines commencing next October, with prizes which will aggregate $12,400. The test is designed to demonstrate the fuel consumption, usefulness, etc., of four-cylinder engines of the automobile type rating between 20 and 30 horsepower.

To find a substitute for a rubber tire for motor trucks has brought forth another novel test, to be conducted by the Austrian Ministry of War. A prize of $10,000 is offered.

Rayfield Carbureter Won

In an advertisement in THE AUTOMOBILE last week of the Master Carbureter Co., Los Angeles, Cal., it was stated that the Mercer car which won the Grand Prize was fitted with a Master carbureter, a mistake due to the compilation of the advertisement in the Advertising Department of THE AUTOMOBILE. The Mercer car, driven by Pullen, used a Rayfield carbureter.

Widow of Chauffeur Recovers for Death

Wisconsin Law, of Far-Reaching Import, Takes No Cognizance of the Employee's Contributory Negligence

MILWAUKEE, WIS., March 7—Wisconsin motor car dealers and garagemen have just come to a sudden realization of their responsibility under the Wisconsin industrial insurance act or workmen's compensation law by the action of the Wisconsin Industrial Commission in requiring the Janesville Motor Co. of Janesville, Wis., to pay $2,740.43 to the widow of Forest E. Gower, a chauffeur for the Janesville company, who was killed in an accident a short time ago. The order says the payment must be made at once and in a lump sum.

Gower was employed as a chauffeur and had taken a passenger from Janesville to Beloit, Wis. On his return trip he backed off a culvert, the machine was overturned, pinning him and a companion beneath. The companion escaped without injury but Gower was instantly killed. Under the Wisconsin law the common law defense of contributory negligence is entirely abolished and the employer is required to pay a certain amount for various injuries or the death of an employee while on duty, regardless of whatever degree of negligence on the part of the employee contributed to the injury or death. An employee is also presumed to be on duty practically from the time he steps on the premises of his employer.

Case Sets a Precedent

The Gower case is of grave importance, as it sets a precedent for all future accidents of this kind and gives employers of chauffeurs or others handling cars very little, if any, chance of escaping payment of heavy damages in case of the death of such employees while on duty, even if the employee is entirely to blame for the accident. It can readily be understood to what extent such negligence or carelessness might be carried in the case of motor car drivers, and the burden upon garagemen and dealers might be almost unlimited.

The Wisconsin workmen's compensation act is declared to be probably the most progressive and advanced legislation of this character in the United States and while it means a hardship on garagemen in some instances, it is generally accepted in a favorable light, inasmuch as it must necessarily be a broad measure which cannot exempt certain classes. The law is, naturally, seeking to protect the workman and at the same time insure the employer a square deal in the matter of collection of damages. The law has made it profitable for employers to throw safeguards around their employees and it is therefore up to garagemen and employers of drivers and chauffeurs to use their best efforts toward the prevention of accidents.

Freak N. J. Bill to Catch Runaway Speeders

NEW YORK CITY, March 9—There is a bill up in the New Jersey Legislature that would make it mandatory for the driver to have on his car a device that upon striking an object with the front of the car, would scatter 72 metal markers in the street. Each marker would be imprinted with the registration number of the car. This is for the identification of the machine in collision should the driver hastily depart from the scene of accident.

Would Graduate New York Registration Fees

ALBANY, N. Y., March 6—A new motor vehicle bill to take the place of the Callan law was introduced on March 4, by Senator W. R. Herrick of New York. This bill provides for higher registration fees than are now exacted by the state, but the scale is so graduated that the owner of the little car will not have to pay more than $10 a year, which is the rate for a car of 20-horsepower weighing less than 2,000 pounds. The bill also provides that operators must be licensed, whether owners or chauffeurs, but that the owners that swear they have driven more than 500 miles need not be subjected to examination. Another new requirement is that all operators shall wear badges.

Under the proposed law motorcycles are licensed on the same basis as are automobiles.

The following will give the five divisions under which automobiles are to be taxed according to the Herrick bill:

First—Those under 22 H.P., and weighing less than 2,000 pounds, paying a license fee of 50 cents a H.P.

Second—Those under 22 H.P., and weighing more than 2,000 pounds, paying 60 cents a H.P.

Third—Those between 22 and 36 H.P., and weighing under 3,000 pounds, paying 70 cents a H.P.

Fourth—Those having between 22 and 36 H.P., and weighing more than 3,000 pounds, paying 80 cents a H.P.

Fifth—Those of 36 H.P. or more, paying $1 a H.P.

Commercial trucks weighing more than 2 tons are to pay the license charge as above, with $10 extra. There is a flat rate of $10 for electric vehicles, except that electric trucks are to pay an excess weight charge of $10.

Activities in Cyclecar Field Continue Unabated

SEATTLE, WASH., March 6—Production of the Columbia, a Seattle-built cyclecar, will begin on February 20 in the plant of the American Cyclecar Co. All the necessary machinery for building the vehicles has arrived and is in place, and just as soon as a big shipment of material is received from the East, the factory will be put into operation. The local factory will start out on 1,000 machines a year schedule, and expects to dispose of its output on the Pacific Coast without difficulty. The company is incorporated under the laws of Washington and has no stock to offer. It is headed by Daniel Murray, a Seattle capitalist; M. M. Cosh, vice-president; and George L. Grant, secretary and general manager. Grant is designer of the Columbia machine. The corporation has recently completed a two-story brick building in the automobile district in this city.

The Columbia machine will have a two-cylinder V motor with a bore of 3 3-8 inches and a stroke of 3 29-32 inches and will be air-cooled. Transmission will be of the friction type with a final drive by means of a "V" belt to the rear wheels. Springs will be semi-elliptic with an underslung channel steel frame. The car will have a wheelbase of 92 inches and a tread of 40 inches.

The wheels, which will be of the wire type, will take 28 by 3-inch tires. Equipment consists of electric lights, electric horn and electric tail light. Top and windshield are listed as extra equipment obtainable for $35.00. The car, with a two-passenger body, will weigh 525 pounds and will be listed at $375 f.o.b. Seattle. The body will be of metal. The two-passengers will be seated side by side, the 40-inch tread offering an unusually large amount of room for a cyclecar. The machine will be built with a streamline body, which will add to its attractiveness.

The Columbia models at first will be turned out with the friction and belt drive to the rear axle, and within the next few months the company will begin the production of front drive cyclecars. Patents are now pending on the Columbia front axle. Both front and rear driven machines will be manufactured.

The Cleveland Makes Its Debut

CLEVELAND, O., March 7—After two months of experimenting the Cleveland Cyclecar Co. has announced it will put on the market a machine to be known as the Cleveland. The company proposes to incorporate for $150,000. The Cleveland has a standard chassis with interchangeable bodies of either roadster or parcels type. The car is equipped with V fenders and has a 96-inch wheel base with a 36-inch tread and is powered with a 4-cylinder motor. Belt drive is used with variable speeds from three to fifty miles an hour.

The company consists of Messrs. Robert Clark, W. E. Burns, W. H. Noyes and others. Clark, the engineer, was engaged in cyclecar development in England.

Cyclecar Heats on Milwaukee Motordrome

MILWAUKEE, WIS., March 6—Cyclecar racing will be developed this season by the Milwaukee Motordrome, constructed early in 1913 by the Milwaukee Motordrome Co., at a cost of $75,000 and since then used exclusively for motorcycle sport. At the annual meeting of stockholders it was determined to take up and initiate the newer sport of matching cyclecars in speed events. Joseph W. Munch was elected manager to succeed Robert Tomsen, promoter of the drome and active head during the first season. The first events are planned for May 30.

Studebaker Profits Are $2,767,458

Sales Increased 17 Per Cent. Over 1912 Records, Amounting to $41,464,950

NEW YORK CITY, March 9—The report of the Studebaker Corp. for the year ended December 31, 1913, shows profits of $2,767,458, a decrease of $575,102 from the previous year, with a total income of $2,850,923, which was a falling off of $614,029. Following the payment of interest, charges, etc., there remained a balance of $871,399, a decrease of $511,021. The profit and loss surplus of December 31, 1913, was $2,099,926.

The sales for the year amounted to $41,464,950, compared with $35,440,328 in 1912, an increase of 17 per cent., and the largest in the history of the business.

The report follows:

	1913.	1912.	1911.
Profit from mfgs.	$2,767,458	$3,342,560	$2,691,848
Other income	83,465	122,392	113,089
Total income	2,850,923	3,464,952	2,804,937
Salaries and depreciation	367,788	339,076	270,895
Balance	2,850,923	3,125,876	2,534,042
Charges	578,722	528,202	483,981
Surplus	1,904,413	2,597,674	2,050,061
Preferred dividend	901,075	930,825	708,750
Balance	*1,003,338	1,666,849	1,341,311
Extra exp. charged off	131,939	284,429	396,479
Surplus	871,399	1,382,420	944,832

*Equal to 3.59 per cent. on $27,931,600 common stock, as compared with 5.96 per cent. on same stock previous year, after deducting 7 per cent. preferred dividend.

The consolidated balance sheet of the Studebaker Corp. as of Dec. 31, 1913, compares as follows:

ASSETS

	1913.	1912.	1911.
Trade name, good will, patents, etc.	$19,807,277	$19,807,277	$19,807,277
Real estate, buildings, machinery and equipment	11,867,962	10,589,651	10,297,480
Foreign trade marks	5,336	5,156	4,892
Investment in other companies	246,509	1,075,692	1,199,640
Inventories	16,622,229	15,730,841	14,391,250
Accounts and notes receivable	5,923,793	4,958,121	5,668,661
Ins. unexp., interest prepaid, etc.	376,520	440,445	263,308
Discount and commissions on notes.	412,859	506,632	381,829
Suspense account	402,496	472,270	489,448
Cash	1,957,460	865,795	1,672,434
Total	$57,622,440	$54,451,881	$54,176,222

LIABILITIES

	1913.	1912.	1911.
Preferred stock	$12,650,000	$13,095,000	$13,268,479
Common stock	27,931,600	27,931,600	27,931,600
Minority, stockholders' interest in capital stock subs. companies	54,341	28,300	28,300
Five per cent. gold notes	6,800,000	7,600,000	..
Notes payable	4,550,000	1,400,000	10,050,000
Drafts discounted	..	..	318,312
Deposits received on contracts for sales of cars	249,594	327,159	321,296
Accounts payable	2,098,134	1,182,944	1,044,623
Sundry reserves	365,120	559,625	268,777
Special surplus account	823,724	*317,009	..
Surplus	2,099,926	1,910,243	944,832
Total	$57,622,440	$54,451,881	$54,176,222

*Applied to purchase of preferred stock for cancellation under provision of charter.

U. S. Rubber's Net Profits $7,140,125

NEW YORK CITY, March 6—The United States Rubber Co. has issued its annual statement for the 9 fiscal months to December 31. Owing to a change in date of the fiscal year from March 31 to December 31, only 9 months' period is covered by the report. The net sales were $87,349,692 and the net profits were $7,140,125. The net sales included footwear, tires, mechanical and miscellaneous goods.

Included in the surplus of $1,811,268, are the earnings of certain subsidiaries for the 3 months ended March 31, 1913, estimated at $764,657. Deducting this and $10,939 applicable to minority interests, there remains a balance of $1,035,672. After adding 4.5 per cent. paid on the common stock, amounting to $1,620,000, the total, $2,655,672, represents the amount available for common dividends for the 9 months, equal to 7.37 per cent. on $36,000,000 common stock outstanding or at the rate of 9.83 per cent. per annum. This compares with 7.46 per cent. for the year ended March 31, 1913.

The company's financial position is strong, the cash on hand being approximately $10,000,000. The company has increased the value of its plants from $105,000,000 last year, to about $118,000,000. This includes the new Canadian plants, Sumatra rubber plantations, and the enlargement of the Morgan & Wright tire plant at Detroit with some minor construction. The year 1913 was a year of declining prices. Consequently the same quantity of manufacturing goods would represent a less amount in dollars and cents. The volume of business of the company as a whole was somewhat larger for the 9 months of 1913 than for the corresponding period of 1912. There was a substantial increase in tire sales through the United States Tire Co.

Automobile Securities Quotations

This week's securities quotations show a few important changes. Goodyear common dropped 75 points due to the sale of $2,000,000 preferred and $2,000,000 common stock. General Motors common rose 5.5 points, and the common stock of the Stewart-Warner Speedometer Co. also experienced a rise, that of 9 points.

	Bid 1913	Asked 1913	Bid 1914	Asked 1914
Ajax-Grieb Rubber Co., com	150	170	200	..
Ajax-Grieb Rubber Co., pfd	95	99	99	102
Aluminum Castings, pfd	98	101	98	100
Chalmers Motor Company, com	115	125	83	85
Chalmers Motor Company, pfd	98	102	92½	94½
Firestone Tire & Rubber Co., com	292	300	288	292
Firestone Tire & Rubber Co., pfd	105	107	109	110
Garford Company, preferred	98	100	80	90
General Motors Company, com	30	32	78½	79½
General Motors Company, pfd	75	77	92½	93½
B. F. Goodrich Company, com	39½	40½	23	24
B. F. Goodrich Company, pfd	98	100½	86	90
Goodyear Tire & Rubber Co., com	385	390	155	165
Goodyear Tire & Rubber Co., pfd	102	103	92½	93½
Gray & Davis Co., preferred	..	..	90	97
Hayes Manufacturing Company	..	90	..	..
International Motor Co., com	5	10	..	5
International Motor Co., pfd	35	45	..	15
Kelly-Springfield Tire Co., com	..	..	57½	58½
Kelly-Springfield Tire Co., pfd	..	..	130	140
Kelly-Springfield Motor Truck Co., com	..	..	*	*
Kelly-Springfield Motor Truck Co., pfd	..	..	*	*
Lozier Motor Company, com	..	..	12	15
Lozier Motor Company, pfd	..	..	..	65
Maxwell Motor Company, com	..	..	5½	6
Maxwell Motor Company, 1st pfd	..	..	27	28
Maxwell Motor Company, 2nd pfd	..	..	9	9½
Miller Rubber Company	185	195	128	132
New Departure Mfg. Co., com	..	..	118	..
New Departure Mfg. Co., pfd	..	..	103	..
Packard Motor Company, com	..	..	101	106
Packard Motor Company, pfd	..	103	96	98½
Peerless Motor Company, com	..	..	20	30
Peerless Motor Company, pfd	..	..	..	80
Pope Manufacturing Co., com	22	25	1	3
Pope Manufacturing Co., pfd	63	68	12	16
Portage Rubber Co., com	..	..	..	35
Portage Rubber Co., pfd	..	..	..	90
†Reo Motor Car Company	20½	21½	18½	19½
†Reo Motor Truck Company	11½	12½	8	8½
Rubber Goods Mfg. Co., pfd	104	106	105	110
Russell Motor Car Co., com	..	..	*	*
Russell Motor Car Co., pfd	..	..	*	*
Splitdorf Electric Co., pfd	..	..	40	50
Stewart-Warner Speedometer Co., com	..	..	56	56½
Stewart-Warner Speedometer Co., pfd	..	..	99	100
Studebaker Company, com	27¾	29	23½	24½
Studebaker Company, pfd	86½	90	80	81
Swinehart Tire Company	95	102	69½	70½
U. S. Rubber Co., com	60	60½	61	61½
U. S. Rubber Co., pfd	104⅞	105⅞	102	102½
Vacuum Oil Co	..	..	214	218
White Company, preferred	103	108	107	110
Willys-Overland Co., com	60	67	66	69
Willys-Overland Co., pfd	92	98	92	96

*No market.

†The par value of these stocks is $10.00. The par value of other stock is $100.00.

Goodyear to Distribute $1,000,000

NEW YORK CITY, March 6—The stockholders of the Goodyear Tire and Rubber Co., Akron, O., recently met to authorize a distribution of $1,000,000 or 20 per cent. in stock to the holders of its common shares. Dividends at the rate of 12 per cent. annually are paid on this stock which is valued at about $225 a share. At the same meeting, the stockholders unanimously approved the plan for the sale of $2,000,000 in preferred and $2,000,000 in common treasury stock. The stockholders have till March 14 to exercise these rights, and have subscribed to practically the whole offering.

Goodrich Re-Elects Officers and Directors

NEW YORK CITY, March 11—The annual meeting of the stockholders of the B. F. Goodrich Co. was held today at the Goodrich headquarters, 1780 Broadway, and all the directors and officers were re-elected for the coming year. W. O. Rutherford was elected as assistant sales manager.

January Exports Worth $2,248,883

2,526 Cars and Trucks Shipped—Gain of 369 Over January, 1913

WASHINGTON, D. C., March 10—Figures showing the exports of automobiles and parts during January last and the corresponding month of last year, together with comparative figures for the 7 months' period ending January, 1913 and 1914, were issued to-day by the Federal Bureau of Statistics. The figures for the several periods for both commercial and pleasure cars, together with parts, are given herewith:

Reeves to Manage C. of C.—Waterman General Manager Hartford Suspension Co.

NEW YORK CITY, March 5—At the monthly meeting today automobile manufacturers elected Alfred Reeves as general manager of the National Automobile Chamber of Commerce to succeed S. A. Miles, who, after 14 years of association work, retires to devote his entire attention to the management of the automobile shows in Chicago and New York and other personal interests.

Mr. Reeves was formerly manager of the Association of Licensed Automobile Manufacturers, and 3 years ago entered the automobile manufacturing trade in the capacity of sales manager of the U. S. Motors. Later he was appointed general manager of the Hartford Suspension Co., Jersey City, N. J., in which concern he resigned from the position of vice-president and general manager. Arthur Waterman, who for the past year has been sales manager for the G. C. Vaporizer Co., New York City, has been made vice-president and general manager of the Hartford company to succeed Al. Reeves.

Report on Legislation

A report on the pending legislation throughout the country affecting motor vehicles was read, and it was found that—more than usual—much of it will prove a genuine hardship to the millions of automobile users. The Chamber voted a declaration of policy to discourage by all proper means the enactment in any State or legislative jurisdiction in this country any legislation which falls within the following classes:

1. Bills which impose local license or registration fees or local regulations upon automobiles or their owners, or which give authority to minor jurisdictions to regulate the operation of automobiles, such license or regulation fees and regulations being in addition to those imposed or fixed by state laws.
2. Discriminatory bills which impose burdens upon automobiles not borne correspondingly by horse-drawn vehicles.
3. Bills, the effect of which is to impose double taxation on automobiles through the imposition of a personal property tax in addition to the exaction of registration and license fees, or otherwise.
4. All acts imposing an occupation tax on either agents or manufacturers of automobiles or restricting or regulating the industry or the trade by special legislation.
5. All legislation requiring the use of specific or proprietary devices or attachments on automobiles in addition to manufacturers' standard equipment.

The report of Mr. Miles, submitted on behalf of the show committee, indicated that the exhibitions at New York and Chicago were the most successful in the history of the industry, there being approximately 10 per cent. increase in attendance at New York. It was estimated that there was an attendance for the week of 125,000. The Chicago attendance showed a greater increase than that of New York.

The makers reported business far in excess of what shows have supplied in the past. There was a bigger attendance of dealers who gave larger orders than heretofore, and the retail sales were in advance of previous years.

Roy D. Chapin of the Good Roads Committee told of the progress being made in the campaign for national aid for better roads, and also reported on the excellent progress being made toward the completion of the Lincoln highway from New York to San Francisco, many cities reporting that the names of their main streets have been changed to Lincoln Highway to conform to the outlined route.

American Plant Sale March 30

INDIANAPOLIS, IND., March 9—The plant of the American Motors Co. will be offered for sale on Monday, March 30, 1914, at 10 o'clock in the morning. Albert Rabb is the referee in bankruptcy and F. E. Smith is the trustee of the estate.

Market Changes of the Week

Few changes of any importance occurred in this week's market reports. Tin dropped $0.12 per 100 pounds. Raw silk from Italy dropped $0.10. Linseed oil rose to $0.53 at a gain of $0.01. Cottonseed oil dropped $0.02 per barrel. Both Electrolytic and Lake copper dropped in prices, the former $0.00 1-10 and the latter $0.00 1-8 per pound.

Material	Wed.	Thurs.	Fri.	Sat.	Mon.	Tues.	Week's Changes
Antimony	.05¾	.05¾	.05¾	.05¾	.05¾	.05¾	....
Beams & Channels, 100 lbs.	1.36	1.36	1.36	1.36	1.36	1.36	....
Bessemer Steel, ton	21.00	21.00	21.00	21.00	21.00	21.00	....
Copper, Elec., lb.	.14 3/10	.14¼	.14⅕	.14⅕	.14⅕	.14⅕	— .00 1/10
Copper, Lake, lb.	.14½	.14½	.14⅜	.14⅜	.14¾	.14⅜	— .00⅛
Cottonseed Oil, bbl.	7.18	7.17	7.20	7.20	7.20	7.16	— .02
Cyanide Potash, lb.	.17	.17	.17	.17	.17	.17	....
Fish Oil, Menhaden, Brown	.40	.40	.40	.40	.40	.40	....
Gasoline, Auto, bbl.	.16	.16	.16	.16	.16	.16	....
Lard Oil, prime	.93	.93	.93	.93	.93	.93	....
Lead, 100 lbs.	4.00	4.00	4.00	4.00	4.00	4.00	....
Linseed Oil	.52	.52	.53	.53	.53	.53	+ .01
Open-Hearth Steel, ton	21.00	21.00	21.00	21.00	21.00	21.00	....
Petroleum, bbl., Kans. crude	1.05	1.05	1.05	1.05	1.05	1.05	....
Petroleum, bbl., Pa, crude	2.50	2.50	2.50	2.50	2.50	2.50	....
Rapeseed Oil, refined	.59	.59	.59	.59	.59	.59	....
Rubber, fine upriver, Para	.73	.73	.73	.73	.73	.73	....
Silk, raw Italy	....	5.25	....	....	5.25	5.15	— .10
Silk, raw Japan	....	4.35	....	....	4.50	4.35	....
Sulphuric Acid, 60 Baume	.90	.90	.90	.90	.90	.90	....
Tin, 100 lbs.	37.75	38.00	37.75	37.63	37.38	37.63	— .12
Tire Scrap	.04½	.04½	.04½	.04½	.04½	.04½	....

EXPORTS OF AUTOMOBILES, TRUCKS AND PARTS IN JANUARY AND PRECEDING 7 MONTHS

EXPORTED	January				7 Months Ending January			
	1913		1914		1913		1914	
Cars:	No.	Value	No.	Value	No.	Value	No.	Value
Commercial	87	$182,271	45	$74,491	462	$872,375	436	$714,261
Passenger	2,070	2,051,806	2,481	2,174,392	11,555	11,350,156	13,553	12,540,593
Total	2,157	$2,234,077	2,526	$2,248,883	12,017	$12,222,531	13,989	$13,254,854
Parts of (not including engines and tires)	.....	$433,936	......	475,299	......	2,538,608	......	3,609,488

EXPORTS BY COUNTRIES FOR THE SEVERAL PERIODS

IMPORTED	January				7 Months Ending January			
	1913		1914		1913		1914	
Cars:	No.	Value	No.	Value	No.	Value	No.	Value
France	73	$59,245	63	$47,506	377	$289,188	464	$361,803
Germany	27	42,659	94	56,483	247	231,035	482	333,544
Italy	20	35,660	64	33,763	168	150,253	195	137,710
United Kingdom	374	258,463	1,030	855,973	1,683	1,268,110	3,512	2,805,325
Other Europe	53	61,937	175	121,245	726	622,542	889	713,091
Canada	468	593,700	370	423,093	3,154	3,886,394	1,895	2,659,482
Mexico	35	48,619	9	15,109	193	339,305	124	207,457
West Indies and Bermuda	68	68,104	58	50,651	255	263,857	334	312,745
South America	351	393,079	145	120,079	1,661	1,842,500	1,348	1,412,340
British Oceania	403	386,833	174	146,672	1,869	1,714,328	2,142	1,846,576
Asia and other Oceania	193	182,660	193	163,641	1,133	1,068,437	1,269	1,251,814
Other countries	92	103,118	151	214,668	551	546,582	1,335	1,212,967
Total	2,157	$2,234,077	2,526	$2,248,883	12,017	$12,222,531	13,989	$13,254,854

London Busses Yearly Carry 551,000,000

Busses Decrease Street Car Traffic—Lessen Congestion—Motor Traffic 29.7 Per Cent.

NEW YORK, March 8—One of the remarkable changes that has occurred in transportation during recent years is the return of traffic to the highways, as shown by figures contained in the report of the London Traffic Branch of the Board of Trade for 1913, recently made public in England. Two-thirds of the grand total of 2,035,000,000 journeys made yearly by passengers in Metropolitan London are now made by public road. Exclusive of the 250,000,000 suburban journeys made on the trunk railroads, and the 50,000,000 trips made by cab, the total number of trips made in the Metropolitan area is given as 1,785,000,000 of which 797,000,000 were made by tram or street car, 551,000,000 by motor omnibus and 436,000,000 by underground and other electric railroads.

In 1912, for the first time, there was an actual decrease of 20,000,000 passengers carried by the street cars, while the number of passengers carried by motor omnibuses increased by more than 150,000,000. The falling off in street car traffic is attributed by the London County Council wholly to the competition of the motor bus.

Remarkable evidence of how motor vehicles lessen traffic congestion is seen in the fact that while the number of passengers carried by omnibus increased from 287,386,471 in 1903 to 551,622,398 in 1912, or nearly doubled, more than 350 fewer licenses were issued for omnibuses in 1912 than nine years before. Of the 3,636 licensed in 1903, only 13 were motor buses, while of the 3,284 licensed in 1912, 2,908 were mechanically driven. There has been a corresponding decrease of more than 1,000 licenses issued in London for cabs or hackney carriages during the same period. Thus, in 1903 licenses were issued for 11,405 cabs, of which one only was motor driven, and in 1912 only 10,354 cabs were licensed, of which 7,969 were self-propelled.

Despite these decreases, there was a total increase in traffic on the streets, as shown by count of 27,682 vehicles in 1913 over 1912 at the same points. This increase amounted to 3.28 per cent. in numbers, but there was a corresponding increase in volume of 5.06 per cent., showing that the congestion advanced more rapidly than the vehicles. A chart printed as part of the report shows that in 1913 the percentages of different forms of street vehicles were as follows in number of vehicles and volume of units:

VEHICLES	PER CENT IN NUMBER.		PER CENT IN VOLUME.	
Horse-drawn trade	27.6		41.	
Horse-drawn passenger	2.3	—29.9	1.6	—42.6
Street car		9.2		28.5
Motor omnibus	11.6		10.8	
Motor cab	6.8		2.1	
Private motor cars	7.7		2.4	
Motor trade vans	3.6	—29.7	3.1	—18.4
Bicycles and motorcycles		27.9		4.3
Barrows		3.3		6.2
		100.		100.

T. C. Frech Becomes Peerless Manager

CLEVELAND, O., March 6—Stockholders of the Peerless Motor Car Co., have elected T. C. Frech a director in place of F. S. Terry. Mr. Frech takes J. B. Crouse's place as vice-president and becomes general manager. Mr. Terry and Mr. Crouse retain all their interests in the company. The officers now are L. H. Kittredge, president; E. H. Parkhurst and Mr. Frech, vice-president; H. A. Tremaine, treasurer, and G. B. Siddall, secretary. R. J. Schmunk, for several years sales manager and for the past year director of sales of the Peerless company has become general sales manager.

To Make Sleeve-Valve Amplex

INDIANAPOLIS, IND., March 9—Melville W. Mix, receiver for the Amplex Motor Car Co., has sold the company's plant and other property to interests represented by H. M. Pulcifer of East Chicago. Mr. Pulcifer submitted the only bid, which was $500,000 and the necessary legal papers making the transfer of the property are now being prepared. E. J. Gulick, former secretary and general manager of the Amplex company, and C. W. Microscope of Chicago, are among those interested.

Organization of the Amplex Mfg. Co. under which name the new owners will operate, is now being completed. Within a few days articles of incorporation, showing an authorized capitalization of $500,000 will be filed with the Indiana secretary of state.

Plans are being made to manufacture a high grade car. It will be manufactured in several models and will have a six-cylinder sleeve-valve motor which has been designed by Mr. Gulick. It is announced that R. W. Randall, who has been works' manager during the receivership, which began last year, is to be continued in a similar capacity by the new management.

Drawback Concessions for General Motors

WASHINGTON, D. C., March 6—A drawback allowance was today granted by the Treasury Department on the exportation of automobiles, automobile chasses, self-propelling trucks, truck chasses, axles, and motor units manufactured by the Buick Motor Co., Flint, Mich.; Weston-Mott Co., Flint, Mich.; Northway Motor & Mfg. Co., Detroit, Mich.; Cartercar Co., Pontiac, Mich.; and the Olds Motor Works, Lansing, Mich., for the use of various imported articles, parts, materials and parts manufactured in the United States with imported material, as specified in the sworn statement of the General Motors Co., Detroit, Mich., the parent company.

The concession was extended also to babbitt metal manufactured by the Frictionless Metal Co., Chattanooga, Tenn., using imported antimony and domestic lead.

WASHINGTON, D. C., March 5—A drawback allowance was yesterday granted by the Treasury Department on the exportation of automobiles and automobile engines manufactured by the Hupp M. C. Co., Detroit, Mich., with the use of thrust bearings manufactured by the Standard Machinery Co., Providence, R. I., with the use of imported steel balls.

Truck Club Wants Bridge and Tunnels to New Jersey

NEW YORK CITY, March 9—The Motor Truck Club of America will hold a meeting on March 18 at the Automobile Club of America. The subject of the evening will be the question of having a bridge or tunnel extended across the Hudson, to take the place of the present ferry system. It is claimed that the motor trucks crossing the Hudson, are held up so long at the ferry stations, that they not only cease to earn money, but are actually losing it, under the present conditions. The present plan would call for the construction of twin vehicular tunnels at Canal street and a bridge at Fifty-seventh street.

INDIANAPOLIS, IND., March 6—The March meeting of the Indiana Section of the Society of Automobile Engineers was held at the Hoosier Motor Club Rooms, Claypool Hotel, Tuesday evening, March 10.

The subject of the evening was Carburetion, a paper being read by P. S. Tice, engineer for the Holley Carburetor Co., on the fundamentals of carburetion and some of the difficulties encountered by the carbureter maker, builder and user.

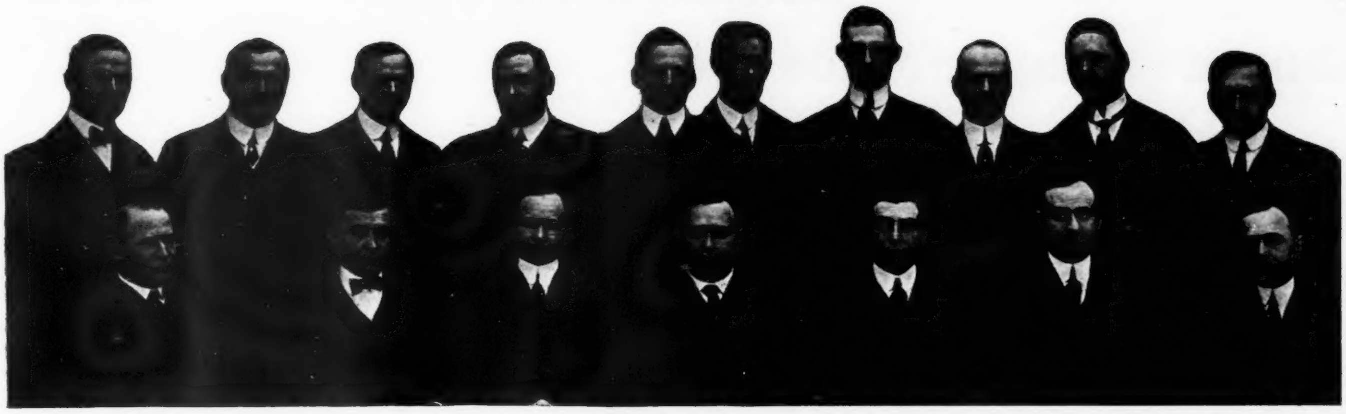
Manitoba Motor League Is Formed

WINNIPEG, March 6—About fifty delegates, the greater number of whom were from outside points, attended the automobile convention called by the Winnipeg Automobile Club this week as a result of which the Manitoba Motor League came into existence, with the following officers elected: Hon. President, C. H. Newton; President, A. B. Stovel; Vice-Presidents, Messrs. Schwartz, Brandon, F. M. Thomas, Neepawa, and Alderman O'Brien, Portage la Prairie; Secy.-Treas., A. C. Emmett.

RICHMOND, IND., March 7—George E. Seidel, of Richmond, Indiana, who is president of the Pilot Motor Car Company and the Seidel Buggy Company, has been elected to the presidency of the Richmond Commercial Club.

$1,275,727.27 in Automobile Licenses for New York

NEW YORK CITY, March 9—The total money paid for automobile licenses in the past year for New York State amounted to $1,275,727.27. This included 118,477 passenger car licenses, 13,780 commercial licenses and 56,702 chauffeur's licenses. The largest single contributor to the state funds, is New York county.



Combined selling and distributing force from the Apple Electric Co., Dayton, O., and the Splitdorf Electrical Co., Newark, N. J. These two companies recently combined: From left to right, standing: F. A. Cornell, business manager Apple Co.; C. P. Brockway, Apple sales engineer; H. J. Hinley, manager of Splitdorf branches in Detroit, Dayton and Cincinnati; E. A. Kelley, manager of Chicago, Kansas City, Dallas and Minneapolis Splitdorf branches; R. S. Allen, European representative Apple Co.; H. E. Borger, engineering department Apple Co.; C. F. Succop, Apple sales department; R. S. Preble, president of Boston and Chicago Splitdorf branches; O. J. Rohde, treasurer and manager New York, Newark, Philadelphia, Atlanta and Toronto Splitdorf branch houses; F. A. Storer, president Buenos Aires Splitdorf branch. From left to right, sitting: E. A. Brackett, engineering department Splitdorf Co.; D. R. Walls, advertising manager Splitdorf Electrical Co.; R. H. Croninger, factory manager Apple Co.; V. A. Apple, president Apple Electric Co.; C. W. Curtiss, general manager Splitdorf Electrical Co.; W. J. Murray, assistant general manager Splitdorf Electrical Co., and H. F. Apple, sales department Apple Co.

Bumper Crop Promise Brightens Iowa Show

Exhibitors Expect to Market 5,000 Cars During 1914 Season—Fifty Make Displays—Record Crowd

DES MOINES, IA., March 6—Des Moines and Iowa interests are centered here this week on account of the fifth annual Des Moines show at the Coliseum. The show opened auspiciously Monday evening with a record crowd for opening night. Dealers and motorists from all sections of the state are here to visit the show and the Des Moines attendance is larger than in former years. The annual meeting of the Iowa State Automobile Assn. will be held here March 11 and that event is helping to attract motor and good roads enthusiasts from outside of the city.

Exhibitors at the show this year are fifty in number. This is less than last year when the balconies of the Coliseum were used for exhibit space. There was a demand for much more space than could be given but the dealers believed it best to keep the show to the main floor and avoid the old plan of balcony exhibits which has proved generally unsatisfactory.

Des Moines has a total of thirty-six dealers and they sell fifty-six different makes of cars. Five of the dealers sell electric cars of various types and twelve handle trucks. There are four big supply houses which all are doing a statewide business and the total number of garages in the city is well over half a hundred.

Dealers and distributors here expect to place 5,000 new cars of all types in Iowa this year. They already have placed orders for one-third of that number and in view of generally excellent crop and industrial conditions the prospects are excellent for the fulfillment of their expectations.

Syracuse Attendance Aggregates 32,500

SYRACUSE, N. Y., March 5—That the people of Syracuse and vicinity have not tired of the automobile show was strongly evident at the sixth annual exhibition of cars and accessories at the State Armory which opened February 24 and closed February 28.

It was estimated that 32,500 persons visited the show, the largest in any previous year despite the fact that the admission was increased from twenty-five to thirty-five cents. About 8,000 persons came from the outlying towns and villages where Syracuse motorcar agents are finding a good field for low-priced cars.

There were thirty-seven different makes of pleasure cars and twenty-one makes of trucks. In the list of cars shown, there were twelve makes entirely new to this city, several of which were factory displays.

From the standpoint of sales, the show was not as productive as in former years, but the exhibitors were well pleased with the large number of prospects. It was agreed that if the weather and road conditions had been better for demonstration, more cars would have been sold. As it was every dealer was loaded up with prospects and well satisfied at the general interest aroused in the new products.

The cost of staging the exhibition was about $8,000, the decorations, which were more elaborate than ever before, costing the committee $2,000. As in the past, the show was conducted by the Syracuse Automobile Dealers' Association with Harry T. Gardner of the Syracuse Rubber Company as manager.

Cincinnati Show Influences Sales

CINCINNATI, O., March 4—With the closing of the annual automobile show this evening Cincinnati dealers are looking forward to a record-breaking season. All have set to work on a high number of prospects listed at the big exhibition and from all accounts sales are going to run far ahead of last year. The exceptionally large attendances at the show lead the dealers to believe that business is going to pick up enormously.

The display was the most successful ever promoted by the Dealers' Association. It opened on February 21, the first week going over to pleasure vehicles and the next four days to trucks.

Toledo Dealers Show at Tiffin

TOLEDO, O., March 7—A large number of the dealers of "automobile row" had exhibits at the Tiffin Automobile Show, which ended at Tiffin today. From a standpoint of interest the show this year was far ahead of that of previous years. A few retail sales were made and a number of agency contracts were closed among the Toledo dealers. The shows in the smaller city have proven especially profitable in getting sub-agency contracts. Those represented at the show were the Maumee Motor Car Co., King and Empire distributors; Baumgardner and Kibby, Oakland; H. E. Throne, Mitchell and Paige; Gamble Motor Car, Hudson; Lichtie Auto Co., Cadillac; Blevins Auto Sales Co., Studebaker; Atwood Auto Co., Overland; Banting Machine Co., Paterson.

Six auto race meets will be held in Toledo the coming season. Toledo will be on an automobile racing circuit.

Second Columbus Carnival a Success

COLUMBUS, OHIO, March 7—Despite the rather unfavorable weather which prevailed part of the week the second annual "Automobile Carnival" given under the auspices of the Columbus Auto Trades Association and the Columbus Automobile Club, which ended today, was a complete success. The results were far in excess of those anticipated by the dealers and it is assured that the carnival will be an annual affair in future years.

Sales were numerous from all of the agencies. During the middle of the week, when the weather was fairly nice, demonstrations were possible. The closing of the carnival was in the nature of a Mardi Gras and a general good time was had.

The closing feature of the carnival was a banquet held at the Hartman Hotel, Mar. 9, when covers were laid for 125.

Some Accessories at Boston Show

Devices of All Kinds for Interest and Comfort of the Motorist Exhibited

FOR years Boston has had the reputation of being the Hub of the automobile accessory industry, and this year's show, although comparatively few of the accessory makers had exhibits, had a number of new and interesting departures in this branch of the motor car business. Some of these devices are briefly described herewith:

Avon Wool Tires

A tire for passenger cars or trucks made of wool cloth, wrapped in concentric layers like a bandage around a finger, and then the entire tread and sides covered with a rubber coating vulcanized on is marketed by the American Tire Co., Avon, Mass. The wool cloth is of different thicknesses according to the kind of tire required. Thus in a truck tire, where great load-carrying capacity and little flexibility are needed, the layers of wool fabric are about 1-8 inch thick, while in a tire intended for light passenger car, the wool would be 1 inch thick. The wool fabric varies in compressibility according to the thickness. These wool wrappings are in as many layers as the tire requires. Thus the 34 by 4-inch tire for a 1-ton truck has a radial depth of 4 1-4 inches of fabric wrapping.

The shape of the tire and cross section are slightly different from those of the solid rubber tire in that the sides are straighter, which is brought about by all of the layers of wool being of the same width. Some of these tires are claimed to have been driven 11,000 miles on passenger cars. The truck tires are made according to S. A. E. requirements and are guaranteed 7,500 to 10,000 miles.

Boston Ford Starter

The Boston starter for Ford cars is a purely mechanical device which by means of a pawl and ratchet equipment fitted on the forward end of the crankshaft, it is possible by pulling a handle extending through the dash, to turn a crankshaft through one-third of a revolution. The pawl and ratchet part is fitted on the forward end of the crankshaft, and with a chain, wheel, and cable combination connecting with the starting handle, so that an upward pull on the handle turns the crankshaft one-third of a revolution and as soon as the motor starts running the pawl and ratchet is liberated. There is an automatic release whereby in case of backfire, the driver cannot be injured.

Calnan Tire Remover

The Calnan tire tool for both removing and attaching clincher or Q-D tires is illustrated in operation at the right, Fig. 3. The tool resembles the jaws of a vise and in emergencies the tool can be attached to the running board of a car and play this rôle in repair work. The jaws spread wider than the wheel felloe and rim and when used to remove a tire that has frozen to the rim it is positioned as shown in dotted lines and when used in removing the ring in a Q-D tire is used as shown in full lines in the illustration. The end pieces of the two screws are loose and as one side of them is flat and the other concaved these can be reversed according to the work to be done. Accompanying the vise is a curved tool, one end of which is a ball to be used as a hammer and the other end a curved prong to pry the ring out in a Q-D, or to aid in loosening the tire. It is made by James P. Calnan, West Upton, Mass.

Cochran Speednut Wrench

A wrench that is automatically fitted to the size of the nut by pushing the wrench handle in the direction it moves when tightening the nut is shown by the Cochran Pipe Wrench Mfg. Co., Chicago, Fig. 1B. The movable jaw J is mounted on a rack R, which rack in turn meshes with a two-toothed quadrant Q on the wrench handle. Pushing down on the wrench handle in the direction you would move it in tightening a nut forces the rack upwards, carrying with it the lower jaw, closing it against the nut. Raising the handle of the wrench loosens the jaw. To use the wrench to unloosen a nut it is turned over and then acts the same as when tightening it.

Colstad Tire Pump

The Colstad Mechanical Laboratories, Atlantic, Mass., is marketing a motor-driven tire pump for Ford cars which is claimed to inflate tires to a pressure of 55 pounds in 3 1-2 minutes. The pump is a small single-cylinder air-cooled one, with cylinder 3-4-inch bore by 1 1-8-inch stroke. The pump is designed to go on the front end of the motor in place of the fan bracket and in installing it it is necessary to take off the present fan, shaft and bracket, and after drilling one 5-16 inch hole in the inside of the fan pulley, according to the template furnished, the fan is mounted in the correct position on the pump shaft and the entire assembly bolted to the motor. To place the pump in action, it is but necessary to pull a small lever until the eccentric which drives the pump meshes with the fan pulley. The pump weighs 3 1-4 pounds and lists at $7.50.

Fox Movable Headlights

The Fox swinging headlights are so designed that the regular headlights are made use of and swing one at a time. When turning the car towards the right only the left headlight swings and on turning the car to the left the right lamp swings. The swinging is done automatically from the steering wheel by means of a locking device which is locked only when the lights are used and unlocked during the day, leaving the lights stationary.

The swinging is all done by steel cables which pass through seamless steel tubes from the base of the steering column to the base of the lights. Mounted over the steering column above the toeboard is a movable sleeve with right and left-hand threads and over these threads pass the steel cables. At their opposite ends these cables attach to short screw threads on the base of the lamp pillar and in the lamp are springs to normally hold the lamp in the forward position, so that when swung to the side by the cable the spring is tightened and immediately brings the lamp back to the straight when the cable is released.

Housel Ford Starter

The Housel starter for Ford cars is a mechanical device attached on the forward end of the crankshaft by a pawl and ratchet arrangement and operated by pedal which when depressed imparts 1-3 revolution to the crankshaft. The starter is mounted behind the radiator. A fan-belt wheel is attached to the crankshaft in place of the one regularly fitted on Ford cars, and this wheel with the lower cog and hand-crank attachment are compactly installed. A flexible steel cable connects the starter arm with the pedal. Price $25.00.

Gasoline Pumplok

The Pumplok, Fig. 5, is an attachment for gasoline pumps whether used in garages or any other place and is a nickel-in-the-slot idea, in that you drop a slug into the lock part before you can turn the handle of the pump to lift a gallon of gasoline. The lock is attached to any make of pump already installed, and secured thereto by locked means. The garage men issue slugs which are numbered to the men, and one must be inserted in the lock for each gallon of fuel pumped. The object of the lock is to check the fuel sold or used by garage attendants, as a protection to the garage owner. Where different pumps require different number of turns of the handle to lift a gallon of fuel, different gearings are provided, the

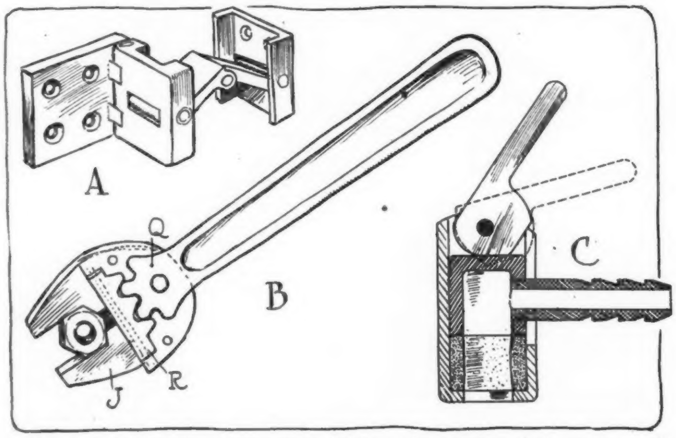


Fig. 1—A Merrimac car door hinge with throw linkage to suit curved doors. B, Speednut wrench which automatically adjusts itself to the nut. C, Thumlock pipe coupling for tire valves

only requisite being to know the make and model of pump. The slugs are very accurately made as to diameter, thickness and weight. The weight is such that a quarter can be used to unlock, and when the quarter is used the Pumplok serves as a vending machine. The attachment measures 7 inches deep, 9 1-4 inches wide and 1 1-2 inches thick.

Kennedy Springless Carbureter

The Kennedy carbureter, Fig. 4, manufactured by L. D. Robbins, Lynn, Mass., possesses several characteristic features. All of the air enters by the one opening A, guarded by a flap valve V, which is weighted at its bottom so as to hang vertically and has a series of holes bored in its top part. The valve is supposed to give a progressional air opening in that first the air will all enter through the holes in the top of the valve but as motor suction increases the valve will swing inwards at the bottom and outwards at the top, until it rests in a horizontal or wide-open position, both the weighted bottom part and the holes in the top part playing respective parts in regulating this opening.

The carbureter has two nozzles, a fixed one N, and a movable one N1, which is interconnected with a special air valve H in the main air passage to the throttle. There is also a gasoline bypass which, when the throttle is closed, allows of gasoline passing direct from the puddle around the main nozzle to the manifold above the throttle.

The valve H in the mixing chamber is a compound type, or is a valve within a valve, the outer part of the valve carrying a smaller disk-shaped valve within it, so that in case of very sudden openings of the throttle the outer part of this valve opens first, and the inner part later, this again giving a progressional control, not unlike that in the valve regulating the main air supply.

Lawrence Motor Lock

A new form of electric-mechanical lock for the emergency brake lever of motor cars has been brought out by the Lawrence Specialty Co., Dorchester, Mass. The Lawrence lock is operated electrically but locks mechanically.

In addition to locking the brake, a combination switch with Yale key is used, one-half of this switch locking the magneto by short-circuiting it on itself and the other half of the switch locking the brake. Fig. 3 shows the switch part that goes on the dash and the part B which is the locking portion for the brake. This box, a small metal one, is inserted in the brake connection, becoming a part of the connection. The arm A depends from the emergency brake shaft and couples at its lower end with a toothed rack within the box B. At its rear end this rack is connected with the brake linkage. Into this rack works a locking pawl which pawl is controlled by an electro-magnet, the electro-magneto, in turn, being regulated by the dash switch. When the brakes are applied by pulling the lever back the pawl drops into the rack by gravity and locks the brake, but to unlock the brake electric connection is established, and the electro-magnet lifts the locking pawl out of the rack.

The Lewis Gearshifter

A mechanical type of gearshifter to be attached on the cover of the gearbox, has been brought out by the Lewis Mfg. Co., Philadelphia. By means of this gearshifter the actual sliding of the gears in the gearbox is accomplished by the clutch pedal, but there is also a selective lever mounted on the steering column

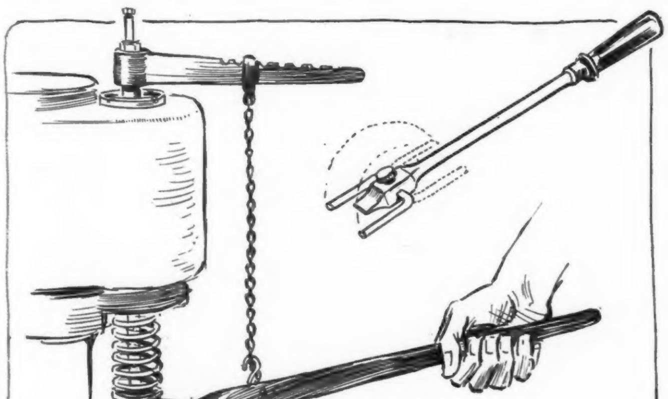


Fig. 2—Winsor valve removing tool which is adjustable to any size of cylinder. At the right, Two-Way valve tool for use as a valve grinder or as a simple screwdriver

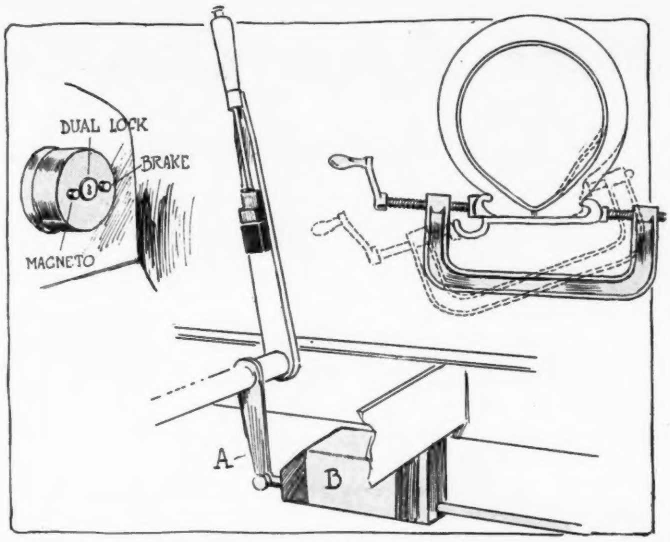


Fig. 3—Lawrence motor lock which locks the emergency brake mechanically and is provided with an electrical release on the brake lever. At the right, the Calnan tire remover for use with clincher or Q D tires

beneath the wheel. In operating the device, the small selector lever is turned to the position to give the desired speed engagement, and when ready to shift the clutch pedal is thrust forward, this forward movement of the pedal not only disengaging the clutch but accomplishing the movement of the gears, the sliding of the gear being timed to follow the disengagement of the clutch.

The Lewis shifter is purely a mechanical device and is carried on top of the gearbox cover or preferably on a cover plate especially made to take it, and which will fit any gearset.

Magnetic Trouble Lamp

The Housel Mfg. Co., Inc., East Rochester, N. Y., manufactures a small electric trouble lamp which has a magnetic base, and by means of which the lamp will immediately stick on any iron or steel object to which it is brought into contact. This is made possible by an electro-magnet in the base of the cylindrical holder which carries the bulb. The bulb is a 6-candlepower one, and is provided with 10 feet of flexible cable which can be connected with a lamp socket or other part of the car for drawing the current from.

Merrimac Door Hinges

Inclosed hinges for car doors have recently been brought out by the Merrimac Hinge Co., Merrimac, Mass. These hinges differ somewhat in design from the conventional inclosed hinge. A, Fig. 1, shows the hinge for the bottom of a curved door in which what is designated a throw linkage is introduced. This throw linkage is readily removable from the hinge proper and throws of different lengths can be used according to the curvature of the base of the door. In order to remove a door with this hinge it is but necessary to take out the screw or hinge bolt A.

A feature of the top hinges is that of a slide engagement which permits of taking the door off by simply lifting it upwards after the lower hinge has been disengaged. This eliminates any necessity of removing screws from the top hinge.

Shimpf Air Starter

A combined air pump and air-starter is shown by the Shimpf Starter Co., Boston. The device is a four-cylinder pump, with cylinders mounted V-fashion, two on each side of the pump shaft. At one time these cylinders act as an air pump and store air in a tank 48 inches long and 8 inches in diameter up to a pressure of 200 pounds; and at other times when starting the air is liberated from the tank and goes into the same air pump cylinders, this time making the pistons work and so cranking the gasoline engine. The control by which the cylinders at one time serve as an air pump and at another time as an air engine is simple and automatic. The pump is driven from the engine crankshaft by silent chain and arrangements are such that the pump automatically cuts out when the pressure reaches 200 pounds in the tank. When using the pump as a starter, a dash control permits of mechanically raising a control valve which admits the air from the tank into the cylinders.

This air pump-starter is made in two sizes, one for motors of 15 to 25 horsepower and the other for motors of 25 to 50 horsepower. Both are alike in design and only different in dimensions. The smaller pump-starter has cylinders 1 3-8 by 2

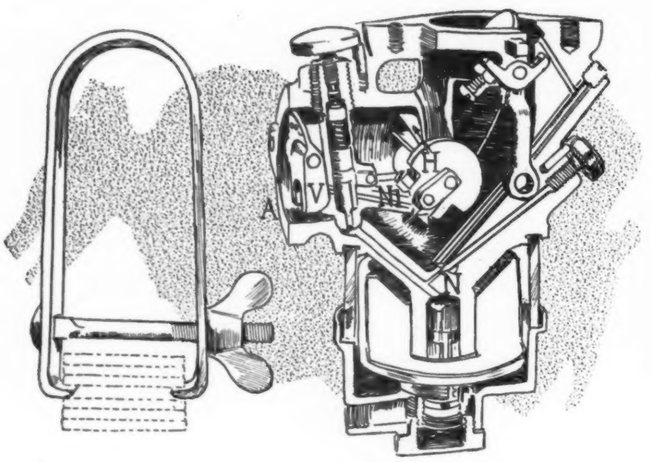


Fig. 4—Security spring spreader for separating spring leaves when lubricating. At the right, the Kennedy springless carbureter which has gravity flap valves for air inlet. All the air enters at A, guarded by flap valve V. The carbureter has two nozzles, a fixed one, N, and a movable one, N1, which is interconnected with a special air valve H

inches and weighs complete, with attachments, 68 pounds. The large pump with cylinders 1 5-8 by 2 1-8 weighs complete 85 pounds. It measures 12 inches long, 8 inches high and 9 3-4 inches wide over all.

All of the air drawn into the four-pump cylinders enters through the breather into the pump crankcase and the escaping air, when the device is used as a starter, escapes through the same channel. The pump cylinders are air-cooled. Thirty starts are claimed in one tank of air.

The Parker Carbureter

In the Parker carbureter, a product of the Parker Carbureter Co., Cambridge, Mass., two devices are made use of to aid in vaporization of the gasoline by heated air. The carbureter has two air inlets one A, Fig. 5, supplied through a hot air horn from the exhaust manifold and known as the fixed air opening. It is at the base of the instrument. The other air opening is a horizontal one at the top of the carbureter and receives cold air. In order to heat this cold air a deflecting plate B is used to direct the cold air towards the bottom of the carbureter where it strikes underneath an umbrella-shaped baffle plate P in the base of the carbureter and surrounding the lower part of the nozzle. This baffle plate is normally heated by hot air entering by way of A and is looked upon to heat the cold air entering through the auxiliary valve. In the top of the carbureter is a screen to prevent back-firing and further aid in breaking up gasoline particles. The throttle, not illustrated, is a butterfly type.

Security Spring Spreader

A simple stirrup-shaped spring divider intended to separate the leaves in a spring in order to oil between them has been brought out by the Security Reliner Co., Montgomery, N. Y. The spreader, Fig. 4, is a steel band bent into stirrup form with pointed edges to be inserted between the spring leaves and a thumb-screw for inserting these edges as desired to separate the spring. It lists at $1.50.

Thumlock Pipe Coupling

The Gurnard Mfg. Co., Beverley, Mass., has a simple coupling, C, Fig. 1, for use on the end of the hose on a tire pump to immediately couple the hose onto the valve stem without screwing it on. The coupling is a short thimble-shaped piece with a rubber thimble or lining inside it. On top is a short handle with a cam end that presses on the top of the rubber thimble, so that in use the open end of the thimble is pressed over the valve stem and when the handle is pressed down, it squeezes the rubber thimble so that it presses inwardly against the sides of the valve stem, forming what is claimed to be an air-tight joint.

The Webber Carbureter

The Webber carbureter built in small quantities in the vicinity of Neponset, Mass., where it is manufactured by Webber & Blomquist, is a conventional design with two air inlets, one at the base, which may be connected with a cross manifold and the other an auxiliary valve regulated through a dash pot. The carbureter uses a vertical air passage extending from the main air inlet to the butterfly throttle at the top, using in this a venturi passage in which is located the spray nozzle. In this nozzle is a needle valve which is raised and lowered by the movement of the auxiliary air valve. There are two adjustments by which the amount of lift of the valve can be varied. The high speed adjusting screw moves a fulcrum which supports the lift bar. The left end of this lift bar is acted upon by a short lever connected with the auxiliary air valve, so that according as the fulcrum is moved to and fro will the high speed adjustment be adjusted. If the fulcrum were moved left until it rested directly beneath a support which is connected with the needle valve, then there would not be any lifting of the valve, and proportionately as the fulcrum is lifted to the right is the amount of lift increased. There is also a low speed adjustment. In order to secure the best possible mixing of air and gasoline vapor there is inserted in the top of the venturi a horizontal fixed baffle plate with spokes resembling the spokes in the fan type of flywheel. The inrushing air impinging on the beveled faces of these spokes imparts a whirling movement to the inrushing gas and vapor.

Two-Way Valve Tool

The L. D. Robbins Co., Lynn, Mass., has a simple screw driver type of valve grinding tool, at the right, Fig. 2, which can be used for grinding valves which have a slot in their top to receive a screwdriver or to grind other valves which have two small holes instead of the slot. In the head of the tool are the two prongs formed in one U-piece so that they can be turned into position for use or out of position, allowing the screwdriver part to be used. A setscrew holds the prongs in either position.

Winsor Valve Removing Tool

The Winsor Mfg. Co., Providence, R. I., markets a tool at the left, Fig. 2, for removing valves which is a simple double-lever device with a chain connecting between the levers. The top lever carries at its inner end a piece that threads into the spark-plug opening and which when threaded still further in, rests on the valve head and retains it on its seating. The lower lever has a yoke at its inner end to span the valve stem and rest against the washer on which the valve spring rests. As the length of the vertical chain connecting the levers can be varied, the tool can be adapted to various sizes of motors.

Yankee Fuel Economizer

The Yankee Motor-Economy Co., Boston, Mass., has a simple attachment by means of which water vapor and outside air are admitted into the intake manifold and it is claimed a considerable increase in fuel economy is thereby obtained. The regulation is through a push-button on the dash. It is intended to admit this combined air and water vapor only after the motor is well warmed up. The device consists of a short series of piping in which one pipe leads from the water system to an atomizer on the dash, and an air pipe also connects with this atomizer. From this atomizer a pipe leads to the intake manifold.

When the motor is running, both the water and air in the pipes are heated because they are in contact with the exhaust manifold and when the control valve on the dash is open the suction in the intake manifold draws hot air and water vapor into the mixture. The water is drawn through a strainer and there is a valve on the air pipe for regulating the quantity.

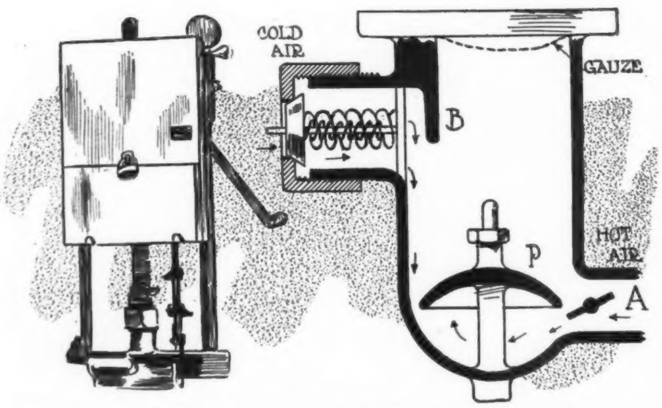


Fig. 5—Pumplok for attachment to gasoline pumps. Slugs are used on the nickel-in-the-slot principle to release the pump. At the right, the principle of air intake in the Parker carbureter. The instrument has two air intakes, one fixed, shown at A, and the other a horizontal one for cold air

Factory Miscellany

CANADIAN Ford's Record Day—Tuesday, February 17, was a record day for the Ford automobile factory at Ford, Ont. On that day the Ford plant built 105 cars and shipped 129. This is the largest production and the greatest activity for any one day in the history of the Canadian Ford plant.

Nyberg Plant for Berlin—It is said that the Nyberg Automobile Co. will erect a factory in Berlin, Ont., and it is announced that the Rutenber Co., manufacturers of automobile engines, will also build a plant there.

Moon's Train-Load Shipment—A solid train load of automobiles in one shipment is the first indication of Spring at the Moon M. C. Co.'s factory in St. Louis, Mo. This shipment went to Sioux City, Iowa.

New Plant for Lima—Lima, O., will soon have a manufacturing plant for the making of tanks, under-pans, fenders, metal mudguards, light radiators and the like, to supply motor trucks in this vicinity. Virgil M. Kline, who has just resigned as purchasing agent for the Gram-Bernstein Co., will be the new manager of this company.

Petrolea Plant on Fire—The Petrolea Motor Car Co., Petrolea, Ont., was damaged by fire to extent of $20,000 on February 22, of which there was insurance of $12,000. Seven complete automobiles which were to be shipped in near future were burned. William English, owner of the motor company, is undecided as to whether the plant will be reconstructed.

Ontario Tire Plant in Welland—The Ontario Tire & Rubber Co., Welland, Ont., has been granted a charter in Toronto. The capital stock is $750,000. The directors are Thomas J. Costello, Buffalo; Robert Cooper, Joseph R. McCollum, George C. Brown and Byron J. McCormick, all of Welland. The company will manufacture tires for automobiles. The vacant Beatty plant in Welland has been leased for the temporary factory of the concern and probably the company will remain in this location permanently.

Gananoque Spring Co. Builds—The Gananoque Spring & Axle Co., Gananoque, Ont., has started up the new spring works that it built to replace the old works which were destroyed by fire last October. The building, which is much larger than the one destroyed, is absolutely fireproof, being built of stone, brick and reinforced concrete, with steel trusses. The sash is of steel, with wire glass, and the entire factory is equipped with double bearings and the latest type of modern spring-making machinery.

Parker Plant Costs $30,000—Announcement was made this week by the Parker Motor Car Co. Seattle, Wash., distributor of the Pullman machine and manufacturer of the Ajax six, that the firm would immediately begin the construction of a two-story brick building at Melrose Avenue and East Pine Street. The structure will cost about $30,000 and will be ready for occupancy on June 1. The Parker company expects to start work on its Ajax factory within the next thirty days. It plans to make delivery of cars by October 1.

Akron Rubber Plant in Ellwood—Negotiations are now under way for the purchase of some land at Ellwood City, Pa., for the erection of a plant for the Akron Rubber Co., of Akron, O., manufacturing automobile tires. Officials of the rubber company have visited Ellwood City for an inspection of the site and stated that they were well satisfied with the location. It is the idea of the company to locate a factory in this section in order to be near the Pittsburgh market and the cheap transportation on the river from Pittsburgh to southern points.

Tire & Rubber Plant Sold—The Tire & Rubber Co. plant, Buffalo, N. J., was sold in bankruptcy court, March 3, by the referee, James W. Persons. The entire stock, consisting of various machinery, offered in separate parcels, brought a bid of only $6,100. They were afterward offered in bulk and sold for $10,250 to Al G. Irr. There was a good deal of competition from various Eastern plants, also from a Canadian syndicate of buyers. Frederick O. Bissell conducted the sale and Referee Persons confirmed it. It is not known what the buyers will do with the property.

Overland Factory fcr El Paso—J. N. Willys, president of the Willys-Overland Automobile Co., while on a visit in El Paso, Tex., stated that his company will erect a branch factory at El Paso to supply the Southwestern California and Mexican trade when peace is restored in Mexico. "After inspecting the entire Southern automobile trade territory I have come to the conclusion that El Paso is the logical location for such a branch of our factory in Toledo," Mr. Willys said. "California, all of Mexico, Arizona, New Mexico and Texas could be served from El Paso."

New Process Gear Extension—The New Process Gear Corp., Syracuse, N.Y., is erecting a new three-story 40 by 100-foot concrete and steel building to provide additional machinery facilities for spur and bevel gear work. This new building is to be absolutely fireproof, with brick curtain walls and concrete floors, and will contain entirely new equipment. Among machines already ordered are 17 Gleason bevel gear generators, 14 Potter & Johnson automatic turret lathes, 6 Gould & Eberhardt bevel gear blocking machines and 2 Fellows spiral gear shapers, all to serve as additions to the larger batteries of similar machines now in service in the main plant.

The Automobile Calendar—Shows, Meetings, Etc.

March 7-14	Hamilton, Ont., Passenger and Truck Show.
March 7-14	Boston, Mass., Automobile Show.
March 9-14	Des Moines, Ia., Show, Des Moines Automobile Dealers' Assn.
March 10	New York City, S. A. E. Iron and Steel Division Meeting.
March 14-21	Lancaster, Pa., Auto Show.
March 17	New York City, S. A. E., Springs Division Meeting.
March 17-21	Boston, Mass., Truck Show.
March 18-22	Sharon, Pa., Auto Show.
March 21-28	St. John, B. C., Show, Armory, New Brunswick Auto Assn.
March 24	New York City, Electric Veh. Assn. Meeting, Engineering Bldg.; T. S. Schoetz, Westinghouse Electric Co., speaker.
March 24	New York City, S. A. E. Broaches Division Meeting.
Mar. 30-April 4	Denver, Colo., Thirteenth Annual Auto Show in Auditorium.
March 31	New York City, S. A. E., Electric Vehicle Division Meeting.
April 7, 8, 9	New York City, S. A. E. Standards Committee Meeting.
April 9-15	Manchester, N. H., Automobile Show.
April 12-19	Prague, Austria, Eleventh Annual International Auto Exhibition, Royal Tiergarten.
April 21	New York City, S. A. E., Research Division Meeting.
May 5	New York City, S. A. E. Electrical Equipment Division Meeting.
May 12	New York City, S. A. E. Ball and Roller Bearings Division Meeting.
May 14	New York City, S. A. E. Motor Testing Division Meeting.
May 25-26	Palermo, Sicily, Targa Florio, 700-Mile Race.
May 30	Indianapolis, Ind., 500 - mile Race, Indianapolis Motor Speedway.
June 1	Palermo, Sicily, Coupé Florio 279 Mile Race.
June 23-26	S. A. E. Summer Meeting, Cape May, N. J., Cape May Hotel.
June 24-26	Chicago, Ill., Seventh Annual Meeting of Nat. Gas Engine Assn.
July 3-4	Tacoma, Wash., Road Races, Tacoma Carnival Assn.
July 4	Sioux City, Iowa, 300-mile Race, Sioux City Auto Club and Speedway Assn.
July 4	Lyons, France, French Grand Prix.
July 13-14	Seattle, Wash., Track Races, Seattle Speedway Assn.
July 25-26	Belgium Grand Prix Road Races.
Aug. 28-29	Chicago, Ill., Elgin Road Races, Chicago Automobile Club.
Sept. 9	Corona, Cal., Road Race, Corona Auto Assn.
Sept. 26-Oct. 6	Berlin, Germany, Automobile Show.
Oct. 1	Paris, France, Kerosene Motor Competition.
Oct. 19-26	Atlanta, Ga., American Road Congress of the American Highway Assn. and the A. A. A.
November	El Paso, Tex., Phoenix Road Race, El Paso Auto Club.

The Week in  the Industry

Motor Men in New Roles

ROBERTS Goes to Standard Truck—W. M. Roberts, formerly general sales manager of the Stewart Iron Works Co., Cincinnati, O., has resigned from that corporation to accept a similar position with the Standard Motor Truck Co., Cleveland, O., with supervision over sales, not only in this country, but abroad. He has established his headquarters at the company's sales offices in Cleveland. This company has accepted plans for additions to its Warren, O., plant, which will provide for a 400 per cent. increase in its output.

Hart Is New Manager—E. A. Hart has just been appointed manager of the New England branch of the Oldsmobile company, with his headquarters in Boston.

Ferry Succeeds Haynes—C. C. Ferry has been appointed manager of the local sales agency of the Lee Tire & Rubber Co., at Philadelphia, Pa., succeeding R. R. Haynes.

Indra Makes Change—L. G. Indra has become secretary and general works manager for the H. J. Nelson Machine Co., now the Nelson-Indra Machine Co., Green Bay.

Sternberg Goes to New York.—H. H. Sternberg, formerly with Alvan T. Fuller in Boston, Mass., selling Packards, has gone to New York to manage the branch there of the Rad-Fix Co.

Hall Now Manager—Stanley F. Hall has been appointed manager of the Boston, Mass., branch of the Swinehart Tire Co. He was formerly with the Kelley-Springfield Truck Co., in Boston.

Curtis Knox's N. Y. Manager—F. A. Curtis has been made manager of the New York City branch of the Knox Automobile Co., Springfield, Mass. Mr. Davis has joined the Knox branch.

Mantell Resigns—C. S. Mantell, sales manager of the Harmon Motor Car Co., Reo and Lozier distributor, Seattle, Wash., has resigned to engage in the automobile business at Wenatchee, Wash.

Willys Resting at Pasadena—J. N. Willys, head of the Overland and allied organizations, is taking a month's rest at Pasadena, Cal., as a guest of J. W. Leavitt, Coast distributor for the Overland car.

Willis Philadelphia Metz Manager—The Metz Co., Waltham, Mass., has established a direct factory branch at 338 North Broad street, Philadelphia, Pa. William Willis has been appointed local manager.

Marsters Joins Koehler Co.—E. R. Marsters, formerly identified with the Maxwell in Boston, Mass., has joined the H. J. Koehler Co., and will travel through New England for that company, selling the Koehler truck.

Firestone Dies—C. D. Firestone died in Columbus, O., March 1. Death was due to apoplexy. He was president of the Columbus Buggy Co., Columbus, O., from its formation in 1875 until its reorganization recently.

Witt La Vigne Sales Manager—Frank Witt, the former racing driver and traveling representative of the Studebaker Corp., and the Krit Motor Car Co., is now sales manager of the La Vigne Cyclecar Co., Detroit, Mich.

Limric Resigns from Goodrich—Howard B. Limric, manager of the New England branch of the Goodrich Tire & Rubber Co., Boston, for the past few years, resigned last week, and he has been succeeded by William H. Moore, his assistant.

Waller in New Capacity—T. B. Waller, former Seattle, Wash., distributor of the Lincoln truck and Imperial pleasure car, is now associated with the Lincoln Motor Truck Co., at Sacramento, Cal., in the capacity of assistant general manager.

Pruden Dies—W. E. Pruden, president of the W. E. Pruden Hardware Co., New York City, died on March 4 at his home. Heart disease is said to have caused his death. Mr. Pruden was also president of an accessory dealers' organization recently formed in that city.

Smith Dies at Home—Dave B. Smith, a prominent salesman in the bicycle and automobile sundries field, died very suddenly at his home in Stoneham, Mass., March 6. He represented the Standard Co., Torrington, Conn., and the Splitdorf Electrical Co., Newark, N. J.

Richards Joins Driggs-Seabury—The Driggs-Seabury Ordnance Corp., Sharon, Pa., has secured the services of C. W. Richards as superintendent of production. Mr. Richards was for several years factory manager of the plant of the Stevens-Duryea Co., Chicopee Falls, Mass.

Alcorn with Transue & Williams—W. C. Alcorn, formerly factory manager of the Consolidated Mfg. Co., has been appointed manager of the sheet metal stamping department of the Transue & Williams Co., Alliance, O. This company recently took over the sheet metal stamping plant of the Davies-Bach Mfg. Co., and is now operating it.

Redden on Long Trip—C. F. Redden, general sales manager of the Maxwell Motor Co., Detroit, Mich., has left Detroit on a 10,000-mile swing through middle-western and Pacific coast territory. Before returning from the coast Mr. Redden will make a side trip to the Hawaiian Islands for the purpose of establishing a Maxwell agency in Honolulu.

Vogelsong General Manager—G. E. Vogelsong, who has been assistant to B. W. Twyman, head of the Twyman M. C. Co., Columbus, O., for 5 years, will be general manager of that company. This company has branches in Cincinnati and Dayton, distributing the Studebaker car. E. A. Neff, the assistant general manager, will be in charge of the Columbus retail store.

Davis Has Lyons Atlas Branch—The interests of the Lyons Atlas Co., Indianapolis, Ind., manufacturer of the Lyons-Knight cars, will now be handled directly by that company in New York City, a factory branch having been established at 1874 Broadway. H. M. Davis, for the past 14 years representative of the Knox company, will be in charge of the branch.

Newell in New Capacity—The firm of Newell & Eccles, recently formed in St. Louis, Mo., to market the Empire Gasoline Economizer, has been dissolved. H. M. Newell, Jr., has been made sales manager of the firm that makes the economizer, the Brown-Taylor-Greene Co., Chicago, Ill. He will be at the Boston, Mass., automobile show. G. C. Eccles will have charge of the Northern district of the Brown-Taylor-Greene business.

Snyder Resigns from Reo—Harry M. Snyder, who has been secretary and a director of the Reo Motor Car Co. and secretary of the Reo Motor Truck Co., Lansing, Mich., has discontinued his connection with those companies. Mr. Snyder has been actively connected with the automobile industry for the past 12 years, with headquarters in Detroit, and is well known to the trade throughout the country. He proposes to retire from business for at least a year, spending the time in travel and other amusement.

Federal Rubber President Honored—Byron C. Dowse, president of the Federal Rubber Mfg. Co., Milwaukee, Wis., has been honored with appointment as member of the national affairs committee of the Milwaukee Merchants and Manufacturers' Assn. B. Rosing, of the A. O. Smith Co., is a member of the committee on safety and sanitation. Victor M. Stamm, president of the Hubmark Rubber Co., is named as member of the jobbers and manufacturers' committee. The association is one of the most prominent in the United States because of the good results accomplished by its various endeavors.

Garage and Dealers' Field

Gasoline Reduced One-Half Cent—Milwaukee, Wis., oil companies have issued a new price schedule for tank wagon deliveries of gasoline, effective March 5, which shows a reduction of one-half cent in the price of sixty-five test gas. Other grades remain the same as for the past month, when a half-cent reduction in all grades was announced. A year ago sixty-five test sold at 18½ cents per gallon in Milwaukee. The present quotation is 15½ cents.

Larsen's New Advertising Scheme—C. Henry Larsen, of the Cutting-Larsen Co., New York City, agent for the Oldsmobile in the metropolitan and surrounding district, placed an order for 1,000 La Vigne cyclecars during January. Mr. Larsen was rather criticized by friends in the trade for the size of the order, and to make a test in the matter had 2,000 postal cards printed bearing the picture of the car and on the front a brief description of the La Vigne. His surprising return from this canvass of the district is the talk of Broadway, for the postal cards brought 400 applications.

Recent Incorporations in the Automobile Field

AUTOMOBILES AND PARTS

BOSTON, MASS.—Mattapan Motor Car Co.; F. T. Meagher, K. A. Meagher and E. R. Meagher.

BRIDGEPORT, CONN.—American Cyclecar Co.; capital, $300,000. Incorporators: I. B. Trumbull, A. H. Trumbull and F. S. Trumbull.

BROOKLYN, N. Y—Oil Engine Corp. of America; capital, $10,200. Incorporators: Isadore Boxbaum, N. Sitren and B. Wechsler.

BROOKLYN, N. Y.—Werchen Garage Co.; capital, $2,500; to carry on a general automobile business. Incorporators: D. Werchen, Daret S. Werchen and Philip Miller.

BUFFALO, N. Y.—The Mogul Truck Co. of Buffalo; capital, $3,000; to deal in motor trucks. Incorporators: E. M. Reickert, O. J. Reickert and A. F. Reickert.

CANTON, O.—The Automobile Products Co.; capital, $150,000; to manufacture automobile parts and other metal products. Incorporators: Daniel Thomas, F. J. Moul and S. Ake.

CHICAGO, ILL.—Baker Electric Sales Co.; capital, $24,000. Incorporators: R. S. Griefen, W. H. Hend and T. J. Condon.

CHICAGO, ILL.—The Standard Motor Car Co.; capital, $10,000; to manufacture and deal in automobiles, motors and accessories. Incorporators: Eric Kullberger, David Gordon and B. Christiansen.

CINCINNATI, O.—The Automobile Equipment Co.; capital, $100,000; to manufacture and deal in motor trucks and automobiles and do repairing for all motor driven vehicles. Incorporators: G. W. Platt, Arno Merkle, Edward H. Maffey, Marmion L. Freeman and Alice DeCharmes.

CINCINNATI, O.—The Court Street Garage and Automobile Co.; capital, $20,000; to do a general automobile business. Incorporator: M. A. Boer.

ERIE, PA.—Erie Penn Auto Co.; capital, $25,000. Incorporators: J. Z. Miller, S. Farmer and R. J. Farmer.

HAMILTON, ONT.—The Keystone Electric Company, Ltd.; capital, $75,000; to deal in automobiles.

INDIANAPOLIS, IND.—The Kuhns Auto Service Co.; capital, $5,000; to carry on a general automobile business. Incorporators: F. W. Kuhns, B. C. Downey and E. L. Kuhns.

LOUISVILLE, KY.—Motor Sales Co.; capital, $6,000. Incorporators: H. O. Herr, R. W. Herr and Addien W. Lee.

MANSFIELD, O.—The League of American Motorists; capital, $1,000; to sell, manufacture and trade in automobiles and supplies of all kinds. Incorporators: J. E. Ladow, Jacob Reinhardt, Morris Kirkpatrick, F. W. Remy, Chas. Ritter.

MILWAUKEE, WIS.—Milwaukee Cyclecar Co.; capital, $75,000; to manufacture cyclecars and other similar light vehicles.

MILWAUKEE, WIS.—The Wisconsin Cyclecar Co.; capital, $25,000; to deal in cyclecars. Incorporators: W. B. Cristie, W. H. Schwab and Walter Fernekes.

MINNEAPOLIS, MINN.—The Clark Auto Co.; capital, $25,000; to carry on a general automobile business. Incorporators: F. C. Clark, Clom Bofferding and J. A. Cronholm.

MONTREAL, QUE.—Canadian Baby Car Co.; capital, $300,000. Incorporators: Napoleon Nantel, J. A. Myette, Henery De Lanauze and Gaspard Thoulin.

MONTREAL, QUE.—Chapleau Wagon and Auto, Ltd.; capital, $100,000. Incorporators: F. H. Chapleau, J. A. Dufresne, E. S. Carter, Rodolphe Langevin and J. P. Lamarche.

MONTREAL, QUE.—Motor Finance Co.; capital, $50,000. Incorporators: E. N. Todd, E. A. Mumford, A. Kornbloom, A. G. Brooks and T. R. Ker.

MT. HOPE, W. VA.—Mt. Hope Garage Co.; capital, $10,000; automobile agency. Incorporators: J. F. Garnet, W. H. Darnell, T. C. Fazelle.

NEWARK, N. J.—Charles E. Ball Co.; capital, $10,000. Incorporators: Chas. E. Ball, H. A. Gillard and W. E. Turton.

NEW YORK CITY.—Benz Automobile Sales Corp.; capital, $25,000. Incorporators: Russell F. Engs, S. F. Engs, Paul V. Cloud and E. R. Pelz.

NEW YORK CITY—Geneva-Bauman Co.; capital, $2,500; automobile and motorcycles. Incorporators: Alexander Bauman, J. I. Geneva, Matilda Lanssman.

NEW YORK CITY—Marmon New York Company; capital, $1,000; automobile business. Incorporators: F. G. Garrie, James B. Curtis, William Shibder.

NEW YORK CITY—Owego Car Co.; capital, $150,000; to do a general automobile business. Incorporators: Geo. R. Ramsey, W. I. Payne, W. Bell.

NEW YORK CITY—R. W. Lewis, Inc.; capital, $10,000; to deal in automobiles. Incorporators: R. W. Lewis, Julius Leeb, Robt. Massey.

NEW YORK CITY—Standard Tractor Co.; capital, $50,000; to manufacture motor tractors. Incorporators: J. W. Blaisdell, Geo. T. Whyte, D. H. Hamie.

NEW ORLEANS, LA.—The New Orleans Cyclecar Co.; capital, $17,500; I. T. Rhea, J. C. Werner and W. S. Campbell.

OKLAHOMA CITY, OKLA.—Fremont Motor Co.; capital, $10,000. Incorporators: R. B. Fremont, Myrtle Fremont, T. J. Wilson and Joseph Fremont.

PORT JERVIS, N. Y.—George W. Case Co.; capital, $5,000; to carry on a general automobile business. Incorporators: G. W. Case, A. B. Case and I. M. Kadel.

RACINE, WIS.—Body factory; capital, $125,000; to make bodies for automobiles and buggies. Incorporators: H. M. Wheeler and J. C. Jones.

RICHMOND, CAL.—The Brown Auto Co.; to manufacture automobiles. Incorporators: H. F. Brown and Chas. Smith.

ROCHESTER, N. Y.—The Curtis-Pembrook Co.; capital, $10,000; to carry on a general automobile business. Incorporators: H. A. Curtis, C. J. Pembrook and Ida A. Pembrook.

ROCHESTER, N. Y.—Wagner-Dolph Co.; capital, $25,000; to carry on a general automobile business. Incorporators: G. J. Wagner, W. L. Dolph and E. K. Van Almkirk.

SAGINAW, MICH.—Hubbell Auto Sales Co.; capital, $10,000; to carry on a general automobile business.

SPENCER, IND.—Spencer Auto & Machine Co.; capital, $6,000; to deal in automobiles. Incorporators: G. W. White, H. B. White, Herbert C. White and others.

GARAGES AND ACCESSORIES

ARDMORE, OKLA.—Ardmore Refining Co.; capital, $30,000. Incorporators: J. B. White, J. S. Alexander and T. C. Brissey.

AUSTIN, TEX.—Fuller Mercantile Co.; capital, $30,000; incorporators: M. B. Fuller, W. O. Looney, J. R. McGee.

BUFFALO, N. Y.—Amper Control Corp.; capital, $100,000; to make control systems for automobiles. Incorporators: E. W. Jones, R. E. Heard and L. C. Kinnius.

BUFFALO, N. Y.—Gray-Line Taxi Co.; capital, $10,000. Incorporators: W. I. Waters, W. H. Reihl and S. S. Jewett.

BUFFALO, N. Y.—Ontario Tire & Rubber Co.; capital, $50,000; to manufacture and deal in tire and rubber goods. Incorporators: H. V. Cock, F. L. Robinson, F. B. Rowley.

BUFFALO, N. Y.—The Velodrome Co.; capital, $30,000; to hold and promote races of all kinds. Incorporators: W. M. Wilson, D. H. Lewis and Fredk. Vokes.

CHICAGO, ILL.—Anchored Non-Skid Chain Co.; capital, $5,000. Incorporators: E. F. Pond, M. J. Lynch and G. M. Semmes.

CHICAGO, ILL.—Grand Garage; capital, $2,000; to manufacture automobiles. Incorporators: F. L. Johnson, John Farr and Elof W. Johnson.

CHICAGO, ILL.—Osgood Autolite Deflector Co.; capital, $50,000; to manufacture and deal in deflectors. S. W. Osgood, William C. Kenner and James Jay Sheridan.

CHICAGO, ILL.—Wentworth Auto Livery Co.; capital, $2,500. Incorporators: W. F. Grieg, Elon Johnson, J. A. Olson and Lorena Peterson.

CLEVELAND, O.—The Automobile Repair and Supply Co.; capital, $5,000. Incorporators: T. A. Cretney, R. H. Reed and C. T. Kirkbride.

CLEVELAND, O.—The Noble Air Pump Co.; capital, $25,000; to manufacture and deal in air pumps of all kinds. Incorporators: E. E. Derr, G. B. Langman, T. S. Dunlap, J. C. Noble and C. H. Truscott.

CLEVELAND, O.—The Waite Auto Livery Co.; capital, $10,000; to operate a garage and taxi business. Incorporators: A. F. Waite, J. B. Oviatt, C. E. Hubbell, C. R. Brown and A. E. Rogers.

COLUMBUS, O—The Columbus Automobile Trades Assn.; capital, $1,000; to hold carnivals and like exhibitions. Incorporators: F. E. Avery, J. P. Gordon, W. J. Miller and L. M. Brown.

FORD, ONT.—The Beeson Non-Skid Tire Band Co.; capital, $40,000; to manufacture automobile accessories. Incorporators: B. N. Beeson and others.

FREEPORT, N. Y.—The Long Island Tire Co.; capital, $1,500; to deal in tires. Incorporators: Marie P. Denton, J. S. Denton and Harry E. Wetzig.

HAMILTON, ONT.—Fox Chain Co.; capital, $200,000. Incorporators: Francis Watts, John A. Donavan, Lillis Sleeth and O. H. King.

HANNIBAL, MO.—Hannibal Garage and Machine Co.; capital, $12,000. Incorporators: Albert Bernauer, V. E. Jessup and A. L. Jones.

LA PORTE, IND.—The Walter Starter Co.; capital, $30,000; to manufacture a starting device for automobiles and tractors. Incorporators: F. H. Walker, W. F. Loofbourrow, D. L. Woofbourrow, E. L. Walker and Dora Walker.

LOCKPORT, N. Y.—Lockport Auto Supply Co.; capital, $5,000. Incorporators: A. L. Noag, J. R. Jelley and E. H. Hubber.

MARSHALL, TEX.—Garage; capital, $20,000. Incorporators: W. K. Henderson.

MILWAUKEE, WIS.—The Firestone Tire & Rubber Co.; capital, $50,000; to deal in tires and rubber goods.

MILWAUKEE, WIS.—The H. L. Haden Co.; capital, $15,000; to deal in motor car accessories and supplies. Incorporators: E. G. Hadden, N. M. Kent, E. J. Kappleman and H. L. Hadden.

MINNEAPOLIS, MINN.—The Tire Supply Assn.; capital, $50,000; to sell all makes of standard tires to patrons of the exchange. Incorporators: M. J. Rosenstein, L. S. Rosenstein, W. Juster and Lewis Rosenthal.

MINNEAPOLIS, MINN.—The Yale Motor Car Co.; capital, $20,000; to carry on a garage and repair shop. Incorporators: N. F. Olson, R. L. Olson, H. Olson and G. A. Nelson.

NEW KENSINGTON, PA.—Dequense Auto Accessories Co.; capital, $10,000. Incorporators: H. P. Koessler, H. V. Donnelly and August Delhave.

NEW YORK CITY.—Commercial Transportation Co.; capital, $10,000; to operate an auto trucking business. Incorporators: H. Simonoff, H. Gottlieb and Gregory Adler.

NEW YORK CITY.—Cota Piston Ring Corp.; capital, $10,000; to manufacture engine parts. Incorporators: C. G. Campbell, W. C. Baird and Stephen S. Newton.

NEW YORK CITY.—Hartford Tire Co.; capital, $10,000; to manufacture and deal in rubber tires and accessories. Incorporators: E. J. Forhan, F. B. Knowlton and A. V. Dowling.

NEW YORK CITY.—Indestructible Tire Corp.; capital, $200,000; to deal in auto tires. Incorporators: J. A. Inslee and Anslem P. Anderson.

NEW YORK CITY.—Lincoln Tire & Rubber Co.; capital, $5,000. Incorporators: O. K. Pacht, David Gross and Jacob Cohen.

NEW YORK CITY.—Panama Tire & Rubber Co.; capital, $15,000; to manufacture and deal in auto tires, etc. Incorporators: A. E. Schwartz, G. L. Lewis and Sidney V. Morris.

NEW YORK CITY.—Royal Welding & Radiator Co.; capital, $2,000; auto repairing. Incorporators: L. H. Moos, I. H. Lambert and Benj. Feldman.

NEW YORK CITY.—S. P. Vaporizer Co.; capital, $10,000; to manufacture and deal in auto accessories, etc. Incorporators: J. V. Waldy, Stanley Y. Beach and Romer Stevens.

RALEIGH, N. C.—Raleigh Taxicab Transfer Co.; capital, $20,000. Incorporators: H. S. Lee, J. W. McGee and L. T. Lee.

REGINA, SASK.—The Bingham Pneumatic Wheel Co.; capital, $50,000.

ROCHESTER, N. Y.—Kinton & Co.; capital, $10,000; to deal in rubber articles. Incorporators: F. C. Vinton, W. E. Kinney and C. E. Graves.

ROCHESTER, N. Y.—The Barclay-Rice Co., Inc.; capital, $25,000; to deal in auto accessories. Incorporators: E. L. Barclay, J. G. Barclay and J. E. Rice.

SALT LAKE CITY, UTAH.—Apperson Motor Car Co.; capital, $15,000. Incorporators: L. H. Becraft, A. W. Schooler and G. F. Horn.

SAVANNAH, GA.—Harris Tire Co.; capital, $40,000; to manufacture tires.

SCHUYLERVILLE, N. Y.—Ford Garage Co.; capital, $3,500. Incorporators: Q. C. Ford, H. A. McRae and Philip Kahn.

SPENCER, O.—Spencer Auto & Machine Co.; capital, $6,000; to deal in automobiles. Incorporators: G. W. White, H. B. White and H. C. White.

ST. LOUIS, MO.—Crescent Motor Car Co.; capital, $50,000. Incorporators: G. A. Root, W. H. Foster and Albert G. Wilson.

ST. LOUIS, MO.—The Automobile Combination Lock Co.; capital, $25,000; to manufacture a lock which by the turn of a knob cuts off ignition. Incorporators: William Graffman, H. W. Hopkins, H. W. Geller and A. A. Beckman.

ST. LOUIS, MO.—Bittel-Leftwich Tire Service Co.; capital, $25,000; to maintain an all-night-and-day service station. Incorporators: C. G. Bittel, Geo. Breaker and B. O. Leftwich.

ST. LOUIS, MO.—The Boyd Supply Co.; to deal in accessories. Incorporators: F. D. Boyd and Francis Bryan.

SYRACUSE, N. Y.—Fuller-Ashley Co.; capital, $1,500; to carry on a general automobile business. Incorporators: W. A. Ashley and Arthur Sweeney.

TOLEDO, O.—McNaul Auto Tire Co.; capital increased from $75,000 to $175,000.

TOLEDO, O.—The American Juvenile Auto Co.; capital $10,000; to manufacture and deal in children's automobiles. Incorporators: Clayton Murphy, W. C. Binns, A. C. Luckin, L. M. Smith and J. H. Friek.

WELLAND, ONT.—The Ontario Tire & Rubber Co.; capital, $750,000.

WINNIPEG, MAN.—The Firestone Tire & Rubber Co.; capital, $5,000; to deal in rubber tires, rubber goods, gasoline, mineral oils, etc. Incorporators: A. O. Myers, J. H. M. Kennedy, E. H. Matheson, P. C. Locke and F. R. Sproule.

WINNIPEG, MAN.—Security Rubber & Supply Co.; capital, $30,000; to deal in rubber tires and cycle accessories.

YOUNGSTOWN, O.—The Consumers Auto Supply Co.; capital, $20,000; to carry on a general garage and accessories business. Incorporators: C. N. Jackson, Max Rease, C. L. Baldwin, A. V. Hineman and E. E. Robinson.

CHANGES OF NAME AND CAPITAL

COLUMBUS, O.—Pharis Tire & Rubber Co.; change of capital from $50,000 to $100,000.

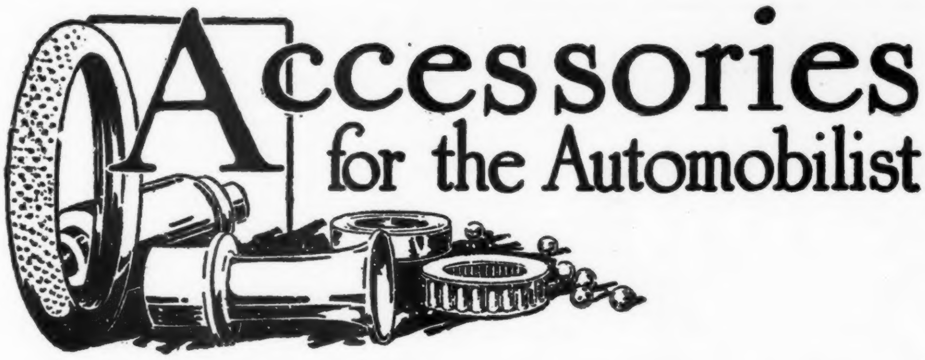
MINNEAPOLIS, MINN.—The McArthur-Zoolars-Thompson Co.; change of name to Minneapolis Auto Co.

SEATTLE, WASH.—Olympic Motor Car Co.; change of name to H. L. Keats Auto Co.

New Agencies Established During the Week

PASSENGER VEHICLES

Place	Car	Agent
Abilene, Kans	Packard	E. E. Coulson
Adair, Iowa	Maxwell	T. N. Elliott
Akron, Ohio	Hupmobile	E E Mellen
Akron, Ohio	Royal-Ohio	C. E. Albright
Albany, Minn	Maxwell	J. T. Brinkman
Albertville, Ala	Maxwell	Hanes Motor Co.
Allentown, Pa	Pullman	H. W. Kline
Alpena, Mich	Maxwell	C. F. Steele
American Falls, Idaho	Maxwell	Wones & Davis
American Falls, Idaho	Royal-Ohio	B. D. Nichols
Amherst, O	Royal-Ohio	Henry Sipple
Anita, Iowa	Hupmobile	L. R. Galiher
Ardmore, Mo	Metz	F. M. Mabrey
Astoria, Ore	Maxwell	Zapf-Nelson Auto Co.
Ashland, Ky	Royal-Ohio	H. D. Wellman
Atkinson, Neb	Hupmobile	W. H. Hitchcock
Auburn, Cal	Maxwell	O. E. Thomas
Auburn, Ind	Maxwell	Campbell & Son
Audubon, Minn	Maxwell	A. Swanson
Battle Creek, Iowa	Maxwell	R. W. King
Battle Creek, Mich	Oakland	W. E. Teeters
Battle Creek, Mich	Royal-Ohio	H. L. Phillips
Barnes City, Ia	Maxwell	Garing Bros.
Bellaire, O	Royal-Ohio	Wm. Ludwig
Beloit, Kans	Packard	Beloit Auto Co.
Blairstown, N. J	Maxwell	Louis Stout
Bloomfield, Neb	Oakland	J. B. Gossard & Co.
Bloomville, O	Royal-Ohio	J. F. Kutz
Bridgeport, Ill	Hupmobile	S. B. Postlethwaite
Brighton, Ill	Maxwell	H. F. Martin
Brooklyn, N. Y	Royal-Ohio	G. L. Bradt
Browerville, Minn	Maxwell	Peter Hermes
Brownstown, Ind	Maxwell	Hackendorf - Roberts & Richards
Bucyrus, O	Royal-Ohio	Hinla-Beach
Buffalo, N. Y	Royal-Ohio	Geo. Fogarty
Burlington, Wis	Detroiter	E. Zwiebel Bros. Co.
Burlington, Wis	Mitchell	E. Zwiebel Bros. Co.
Calva, Ill	Maxwell	A. L. Swanson
Camden, S. C	Hupmobile	W. R. Eve, Jr.
Cameron, Tex	Hupmobile	J. H. Gandy
Carthage, Tex	Maxwell	O. E. Jones
Center Junction, Ia	Hupmobile	M. G. Alsever
Chagrin Falls, O	Royal-Ohio	Stoneman Hdwe. Co.
Chanute, Kans	Packard	Chanute Auto Co.
Chester, Ill	Metz	Herschbeck Bros.
Chicago City, Minn	Maxwell	Sholholm Bros.
Chicago, Ill	Royal-Ohio	Ohio Motor Co. of Ill.
Clarksville, Mich	Maxwell	H. N. Getty & C. Roth
Clearfield, Utah	Maxwell	Clearfield Merc. Co.
Cleveland, O	Royal-Ohio	Gabriel Cge. & Wagon Co.
Cleveland, O	Royal-Ohio	J. P. Keopke
Cleveland, O	Royal-Ohio	A. B. Manley
Clyde, O	Royal-Ohio	R. C. Sanford
Coleman, Texas	Maxwell	C. P. Roquemore
Columbia County, Ore	Ford	Columbia County Auto Co.
Columbus, Ga	Oakland	L. M. Thweatt
Columbus, O	Auburn	Pausch - Selbach Wagon & Auto Co.
Concordia, Kans	Baker	Concordia, Kan.
Concordia, Kans	Packard	Concordia Garage
Corning, Ia	Oakland	Mack Bros.
Corydon, Ind	Maxwell	V. H. Bulleit & Sons
Council Bluffs, Ia	Royal-Ohio	E. E. Gray
Danbury, O	Royal-Ohio	J. Butler
Danbury, O	Royal-Ohio	Walter Lammers
Davenport, Wash	Henderson	C. L. Powers
Dayton, O	Oakland	H. H. Barton
Defiance, O	Hupmobile	Clint Colwell
Del Rio, Tex	Maxwell	F. Dietert & J. Dobkins
Delta, Colo	Maxwell	W. A. Davis
Dixon, Mo	Metz	R. L. Rolens
Dover, N. H	Pullman	E. D. York
Dublin, Tex	Hupmobile	N. J. Keith
El Paso, Tex	Pullman	J. F. Harrel, American Garage
Erie, Pa	Pullman	Erie Penn Auto Co.
Esmond, S. D	Maxwell	C. A. Wickle
Evansville, Ind	Dorris	D. D. Stewart
Ewing, Mo	Maxwell	E. S. Terpening & C. W. Terpening
Falls City, Neb	Maxwell	Kentopp Bros. Auto Co.
Farragut, Ia	Maxwell	Farragut Auto Co.
Florala, Ala	Maxwell	J. H. Burgess, Jr.
Florence, S. C	Hupmobile	C. R. Smith
Fort Dodge, Ia	Franklin	J. W. Crouse
Franklin, Pa	Royal-Ohio	Grove City Garage
Franklin, Pa	Royal-Ohio	J. A. & Chas. Pyle.
French Camps, Miss	Hupmobile	J. W. Howell
Frontenac, Minn	Maxwell	Milwaukee Elevator Co.
Ft. Wayne, Ind	Royal-Ohio	Auto Supply Co.
Fulton, O	Royal-Ohio	A. L. Pipes
Galena, Ill	Pullman	B. F. Burton
Geddes, S. D	Hupmobile	W. H. Fowler
Geneva, Ill	Pullman	Pontius Bros.
Hanford, Cal	Maxwell	Hanford Garage
Hampton, Neb	Maxwell	Hampton Auto Co.
Harrisburg, Iowa	Hupmobile	T. C. Dempewolf
Harrisburg, Pa	Royal-Ohio	Ensminger Motor Co.
Hartford, Conn	Grant	Imperial M. C. Co.
Hartford, Mich	Maxwell	S. Doyle
Hartford, Conn	Mitchell	Palace Auto Service Co.
Hartford, Conn	Royal-Ohio	G. I. Whitehead
Hartley, Iowa	Hupmobile	J. C. Bradstreet
Hecla, S. D	Hupmobile	A. G. Street
Henning, Minn	Maxwell	Cordes Bros.
Hillsboro, Tex	Hupmobile	T. L. Newton
Hillsboro, O	Royal-Ohio	Scott Skeen
Hitchcock, Okla	Maxwell	J. E. Crankhite
Hope, Minn	Hupmobile	Slezak Bros.
Huntington, Ind	Maxwell	Central Garage
Huntington, W. Va	Royal-Ohio	H. P. McColm
Indianapolis, Ind	McFarlan	McFarlan Motor Co.
Indianapolis Ind	Saxon	V. H. Whitesides
Indiana, Pa	Franklin	Clymer Motor Co.
Ishpeming, Mich	Royal-Ohio	P. J. Denn
Jacksonville, Fla	Maxwell	Shackleford & Young
Jasper, Ala	Maxwell	Jasper Auto Co.
Joplin, Mont	Maxwell	M. B. Meagher
Joplin, Mo	Packard	Kleinschmidt & Hempill
Junction City, Kans	Packard	Wenger & Brockman
Kansas City, Mo	Pullman	D. F. Piassek
Kimball, Minn	Maxwell	N. A. Brown
Kingsley, Iowa	Hupmobile	Tom Sheaffer
Kountze, Texas	Maxwell	W. S. Parker
Lawrence, Kans	Packard	Lawrence Street Motor Co.
Little Falls, Minn	Hupmobile	Dr. J. H. Newman
Logan, Utah	Maxwell	Utah-Idaho Auto Co.
Ludington, Mich	Pullman	Cartier Auto Garage Co.
Lufkin, Tex	Maxwell	S. H. Kerr
Luverne, Ala	Maxwell	J. C. Allen
Luverne, Ala	Oakland	A. L. Watts
Manhattan, Kans	Packard	Whitelock Garage
Marshall, Minn	Maxwell	R. M. Addison & Sons
McDermott, O	Royal-Ohio	F. M. Waller
McPherson, Kans	Packard	Talbot & Gilson
McRae, Ga	Oakland	A. W. Anders
Metropolitan, Ill	Royal-Ohio	J. W. Green
Middlesborough, Ky	Maxwell	H. E. Motch
Minneapolis, Kans	Packard	Gage Auto Co.
Moberly, Mo	Packard	E. E. White
Mohall, N. D	Maxwell	Robinson Bros. & Co.
Monticello, Ga	Hupmobile	Dr. F. S. Belcher
Mount City, Ill	Maxwell	W. T. Kennedy
Mt. Pleasant, Mich	Oakland	T. H. Battle
Newark, O	Royal-Ohio	J. F. Priest
Newberg, Ore	Maxwell	L. M. Smith Garage
New Canaan, Conn	Maxwell	E. A. Guthrie
New Castle, Pa	Pullman	Turner Bros.
New Holland, Pa	Pullman	G. W. Kinzer
North Clymer, N. Y	Hupmobile	W. H. Newell
Odessa, Wash	Henderson	A. R. Gray
Ogden, Utah	Maxwell	Becraft Auto Co.
Opelousas, La	Maxwell	Opelousas Merc. Co., Ltd.
Orlando, Fla	Maxwell	Palma Auto Co.
Oshkosh, Wis	Cadillac	S. B. Friday
Oshkosh, Wis	Jeffery	Mikesell & Doman
Park City, Utah	Maxwell	B. E. Hartwell
Parsons, Kans	Packard	C. E. Ervin
Pine Bluff, Ark	Maxwell	Mann M. C. Co.
Pioneer, O	Maxwell	C. A. Deitz
Philadelphia, Pa	Royal-Ohio	B. H. Kirkbride
Pittsfield, Ill	Maxwell	F. G. Turner
Plankington, S. D	Hupmobile	Frank Bohe
Pleasant, Utah	Maxwell	Ed. Johnston
Pocahontas, Ill	Metz	E. R. File & Co.
Pocatello, Idaho	Maxwell	Mooney & Huff
Ponca, Neb	Hupmobile	A. H. Hilles
Ponce, Neb	Maxwell	W. E. Andrews
Pottsville, Pa	Maxwell	Joseph Davenport
Red Oak, Ia	Maxwell	Haas & Milledge
Reno, Nev	Maxwell	H. Anderson, Jr.
Richwood, O	Maxwell	W. H. Conboy
Rochester, N. Y	Royal-Ohio	F. Porschet
Rockford, Wash	Henderson	Dr. Speck
Salt Lake City, Utah	Maxwell	Siegel Auto Co.
Salina, Utah	Maxwell	W. H. Brown
Salina, Kans	Packard	Ollinger Auto Co.
Santa Monica, Cal	Maxwell	H. A. Stevens
Santa Rosa, N. M	Hupmobile	A. J. Nusome & M. G. Nuckles
Schenectady, N. Y	Royal-Ohio	W. D. Havens
Schulenberg, Tex	Royal-Ohio	C. A. Vogt
Schuyler, Neb	Maxwell	Schuyler Motor Co.
Shelbina, Mo	Metz	Sanders Motor Co.
Shelby, O	Royal-Ohio	A. W. Stevens
Sherbrooke, Que	Royal-Ohio	J. W. McKee
Sheridan, Wyo	Maxwell	Derfenderfer & Dinwiddie Auto Co.
Sherrard, W. Va	Royal-Ohio	D. M. Garvin
Sherman, Tex	Maxwell	W. A. Bailey
Sikeston, Mo	Hupmobile	Lancaster, Keller & Co.
Spokane, Wash	Oakland	Inland Motor Co.
Spokane, Wash	Royal-Ohio	W. B. Hill Cycle & Car Co.
Springfield, O	Studebaker	King Garage
Springfield, Mo	Packard	Jess & Sturdy
St. Anthony, Idaho	Maxwell	M. V. Cochins
St. Clair, Mich	Maxwell	A. A. Stewart
Stephenville, Tex	Maxwell	Perry Hdwe. Co.
St. Henry, O	Royal-Ohio	Wm. Romer
St. Joseph, Mo	Packard	Selden-Maxwell Co.
Tampa, Fla	Royal-Ohio	A. J. Reynolds
Texarkana, Ark	Maxwell	J. P. Cook
Thomaston, Ga	Maxwell	King & Wheless
Thomaston, Ga	Oakland	B. H. Ingram
Thornville, O	Ford	Boring & Swartz
Tiffin, O	Jeffery	P. H. Reif
Toledo, O	Royal-Ohio	J. Franke
Trure, Iowa	Maxwell	Trure Automobile Co.
Tulsa, Okla	Franklin	Chapple Bros. Garage
Twinsburg, O	Maxwell	G. A. Deisman
Urbana, O	Studebaker	Prince Garage
Utica, N. Y	Pullman	E. R. Gardiner
Utica, N. Y	Royal-Ohio	L. Davies
Venus, Tex	Hupmobile	R. S. Morris
Wakefield, Neb	Hupmobile	C. A. Samuelson
Wapakoneta, O	Studebaker	Hauss & Bitler
Waterville, Wash	Maxwell	C. H. Hornburg Auto Co.
Waynesburg, Pa	Oakland	Hoover Auto Co.
Wheeling, W. Va	Royal-Ohio	L. M. Danner
White Earth, Minn	Hupmobile	Geo. McLean
Whiting, Iowa	Hupmobile	A. B. Elliott.



Accessories for the Automobilist

TOLMAN'S WELDING OUTFIT—A complete line of oxy-acetylene welding and carbon removing apparatus is made by the Tolman Mfg. Co., Boston, Mass. Welding outfits complete with the exception of oxygen and acetylene tanks are made for $65 and $75, oxygen-acetylene torches capable of cutting metal 12 by 12 inches in 3½ minutes are offered at $100, and an oxygen decarbonizer, which is known as the Norfolk, is made for $35. The latter is of special interest because it not only removes the bulk of the carbon by the preliminary oxygen process, but follows it up with a spray of burning oil which relights the patches that have been missed and allows the oxygen to completely consume them.

A complete welding outfit is shown in Fig. 1, while its use is illustrated in Fig. 2. The equipment that goes with the outfit includes a welding torch, six tips, two pressure regulators, hose and connections, fluxes and brazing materials and a pair of goggles. An interesting feature on these torches is a button that cuts off the oxygen supply without changing the adjustment. This serves two purposes. In case of a flashback the torch may be relighted by pressing the button and shutting off the oxygen supply. Sometimes a good light is wanted for inspecting the work. This can be obtained by pressing the button which shuts off the oxygen, and thus a bright acetylene light is obtained. Ball and socket needle valves are used for adjusting the oxygen and acetylene and give a very delicate adjustment.

One of the most important parts on a welding or carbon removing outfit is the regulator, as it is essential that a uniform pressure be supplied to the torch tips no matter what the pressure in the tanks amounts to. A very simple and effective regulator is used by the Tolman company and it is claimed that its construction is such that it will never get out of order. Two regulators are supplied with each outfit, one for the oxygen and one for the acetylene, and a pressure gauge is fitted on each side of the regulator, one gauge shows the pressure in the tank and thus indicates the amount of gas in it, and the other shows the pressure at the torch nozzle.

Fig. 1—Tolman welding outfit with case

Fig. 2—Tolman welding outfit in use

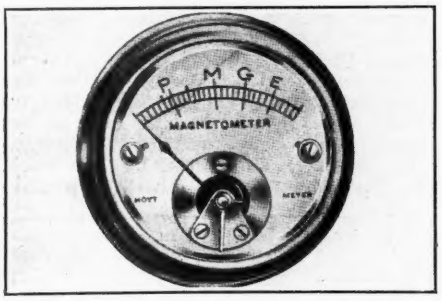


Fig. 3—Hoyt Magnetometer for Fords

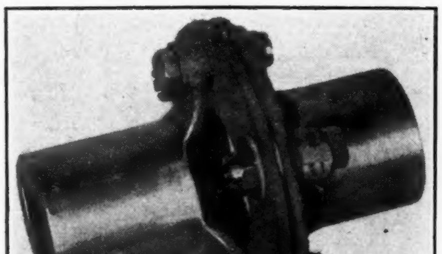


Fig. 4—Blood Bros. leather universal joint

Hoyt Magnetometer—An interesting instrument has been announced by the Hoyt Instrument Works, Penacook, N. H., for testing Ford magnetos. This instrument is designed to show whether the magneto is operating properly and thus indicates whether the trouble is in the magneto or some other part of the ignition system. The magnetometer, Fig. 3, resembles a voltmeter but instead of having its indicating dial marked off to read volts, the scale is divided into four spaces marked off by the letters E, G, M and P. These letters signify the condition of the magneto—E is excellent, G is good, M medium and P poor. The lowest point at which efficient ignition can take place is indicated by the letter G. The installation of the magnetometer is simple, one wire is attached to the insulated plug on the top of the flywheel housing and the other wire is grounded on the frame.

After installing this instrument the operator should make note of its readings at various car speeds as shown by the speedometer, and then by occasionally comparing the readings of the magnetometer, the performance of the magneto at different speeds can be obtained. Without such an instrument as this, when ignition trouble occurs, it is difficult to determine whether the trouble is in the magneto, the coil or in some other part of the electrical system; but by the use of this instrument it is easy to find out just where the difficulty lies. The price of the Magnetometer complete is $4.

Blood Bros. Leather Universals—Universal joints that are particularly adapted to cyclecars are made by the Blood Bros. Machine Co., Kalamazoo, Mich. These joints, Fig. 4, are strongly constructed, having a double thickness leather disk between the two halves of the joint. The advantages claimed for these joints are that there is no chance of loose play developing, that they do not require lubrication and that they are much lighter and simpler than joints with metal bearings. When the disks wear out, they can be replaced for less money than similar parts in the ordinary type of universal. The leather joint can be used wherever flexibility is required providing that the angular movement is not over 5 degrees.

K-W Autolock—The K-W Ignition Co., Cleveland, O., has recently added to its line of accessories for Ford cars the K-W Autolock switch, Fig. 5. This device replaces the ordinary switch and can be installed in ten minutes with an ordinary pair of pliers and a screwdriver. As it is equipped with a Yale pick-proof lock it absolutely prevents theft. It is applicable to any form of ignition, and is very simple in operation. To start, insert key and turn to battery or magneto, as desired. To stop, turn key to neutral. To lock car, simply withdraw key. Without the key in the lock it is impossible to operate the switch, even if the screws are removed. This device can be bought separately, or if desired, as regular equipment when

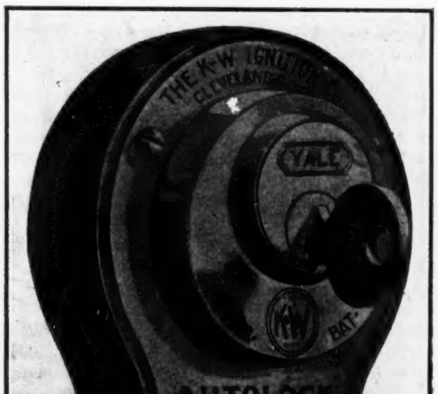


Fig. 5—K-W Autolock for Ford cars

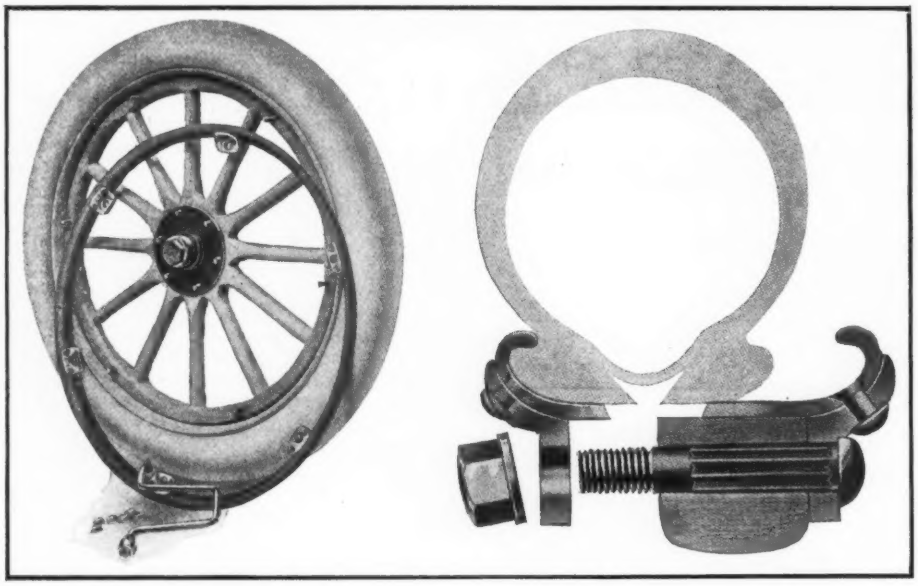


Fig. 6—E-Z quick detachable rim—Left, method of dismounting tire. Right, cross section through rim

ordering a K-W Master Vibrator, at a slight additional cost.

E-Z Rim, Quick Detachable—A quick detachable rim, Fig. 6, that has for its leading feature ease of detachability, has been brought out by the E-Z Rim Co., Boston, Mass. A set sells for $15, and they can be fitted to any make of car without making any change in the present wheels except to remove the rims now in use and replace them with the E-Z rims. This change does not involve alterations in the spokes or felloes of the wheels.

The tire is held on the wheel by a ring that is fastened by six nuts. When it is to be removed these nuts are taken off and then the ring is pulled off and the tire can be removed without difficulty. The ease with which the tire can be taken off or put on is the point upon which special emphasis is laid by the E-Z Rim Company, as there are no split rings, cams, levers or other moving parts to get out of order or to cause trouble.

Shaler Safety Vul-Kit—The most recent addition to the line of vulcanizers produced by the C. A. Shaler Co., Waupun, Wis., is the Safety Vul-Kit, Fig. 7, which is designed for the use of the individual owner and which sells for $3.50. It burns gasoline or alcohol and is so compact that it can be carried in the tool box so that repairs can be made on the road, if necessary. The Vul-Kit will mend any blowout or puncture as perfectly and as permanently as the most elaborate outfit. No skill is necessary in order to make a satisfactory repair, as all that is required is to clean the cut well, then fill it with new rubber, clamp on the vulcanizer, and fill and light the generator. The fuel supply is limited to that required for perfect vulcanization and therefore there is no danger of under or overcuring the rubber.

Micro Piston Rings—A new piston ring, Fig. 8, has recently been brought out by the Micro Piston Ring Co., 1960 Broadway, New York City. It is called the snug-fitting ring because the material used in its construction is especially adapted for piston rings, it is claimed. Micro piston rings are made either with a lap or diagonal joint and are eccentric. The material used in them is a special mixture of processed gray iron, and the rings are made from individual castings which are close grained and tough. The rings are softer than the cylinders and yet have proper strength and flexibility, these three qualities combining to give a ring that will give the best possible performance under all conditions of service. These rings are made in all sizes to fit practically all the makes of pleasure cars and motor trucks now in existence, and the prices vary from 35 cents to $1.15, depending on the size of the piston and the width of the ring.

Veeder Chronodometer—A combination odometer and an eight-day Waltham automobile clock has just been brought out by the Veeder Manufacturing Co., Hartford, Conn. These two instruments are neatly combined in one case, Fig. 9, making a compact instrument and one that looks as though it was designed as one unit and not as a clock with an odometer attached to it. The odometer is placed below the clock base, the register at the right showing the total number of miles and the one to the left the miles per trip. The latter registers up to 99.9 miles by tenths and may be set to zero while the former records up to 9,999 miles and cannot be set back. The instrument is fitted with a flexible shaft which is driven from the front wheel. The driving shaft is made of imported piano wire coiled helically and runs in a steel sheathing, which is in turn protected by a porpoise hide covering that keeps the grease in and at the same time prevents moisture and dirt from entering. The ends of this shaft run on ball bearings and the driven gear is of the twisted tooth type. This gear is made from a piece of sheet steel, the teeth being formed by twisting the edge of the sheet.

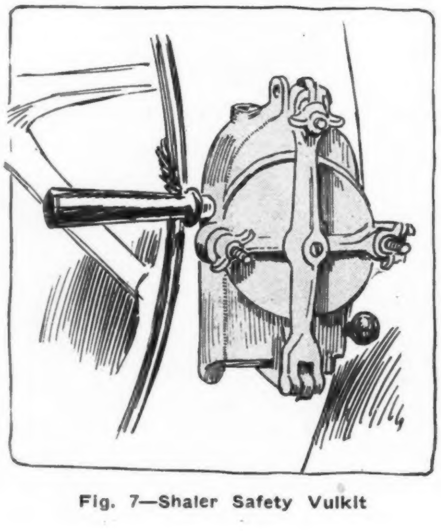


Fig. 7—Shaler Safety Vulkit

Invader Quart Bullet—Something new and original in the automobile oil industry is being placed on the market by the Invader Oil Company, New York City. This comes in the way of a one-quart lithographed package of Invader automobile cylinder oil, which is sealed and which cannot leak.

When the motorist travels and has to stop for oil, the quantity he usually wants is a quart,—and heretofore he has had to take this from a more or less dirty tin measure, which is carried out to him and from which some kind of oil is poured into his car. He does not know what oil he gets,—he is not sure that the oil is clean,—and he does not even know if he is getting full measure.

The Invader "Quart Bullet" does away with all this and will eventually revolutionize the transient oil business, it is claimed. It can be handled by anyone, is neat, and clean and more than one bullet can be taken along if necessary and carried in the tool box.

Holbrook Rawhide Hammers—Rawhide hammers and hide-faced mallets are made by the Holbrook Rawhide Co., Providence R. I. The hammers are double ended and are faced with rawhide, while the mallets have heads made entirely of the crude pelt. These mallets are very light, but a heavier one is made with a strip of soft metal in the center of the hide. The prices vary from $3 per dozen up.

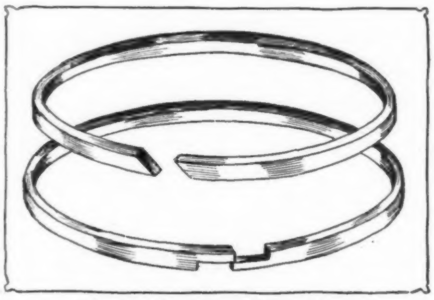


Fig. 8—Micro piston rings

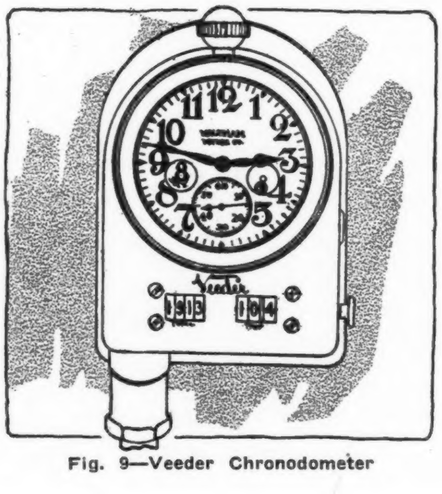


Fig. 9—Veeder Chronodometer